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EXPERIMENTS ON WINTER TERRITORIALITY OF THE AMERICAN KESTREL, *FALCO SPARVERIUS*

BY TOM J. CADE

DESPITE some salutary criticism (Lehrman, 1953) levied at the excessive use of hypothetical systems by the "ethologists," it seems that the methodology of these investigators offers possibilities for sound research into fields of animal behavior that have as yet been little explored by American scientists. For instance, Howell and Bartholomew (1952; 1954) have recently employed some of the ethologists' techniques in a meaningful way without resorting to the construction of elaborate hypotheses or becoming embroiled in a tortuous vocabulary. I refer, of course, to methods of *experimenting* with wild animals in the natural environment and, especially, to the introduction and manipulation of stuffed dummies, of various sorts of models, and captive, live animals into social situations involving wild creatures (see Tinbergen, 1948).

In the fall of 1952 I became interested in exploring the possibilities of using captives and stuffed dummies as aids to a comparative behavioral study of the long-winged hawks, genus *Falco*, on which I have been working for the past several years. Previously I had carried out a few cursory experiments with Peregrines (*Falco peregrinus*) and Gyrfalcons (*Falco rusticolus*) in Alaska with results indicating the desirability of a more thorough investigation than I could conduct in the wilderness areas where these two species were studied. I chose the American Kestrel (*Falco sparverius*) as the species for study because it is the commonest and most approachable falcon of southern California. I knew from casual observations that individuals of this species take up winter territories, and this was the aspect of behavior that I wanted to study.

It will be noted that I use the common name 'American Kestrel' in preference to the name 'Sparrow Hawk' for this falcon. The latter name was first applied to *Falco sparverius* in ignorance. Because it has had a long history of prior use for a true hawk, *Accipiter nisus*, the adoption of this name for our American falcon has been a constant source of confusion in the literature, especially when Latin names do not accompany the vernacular ones. The name 'American Kestrel' relates our species to its closest congener, *Falco tinnunculus*, and is more desirable from the standpoint of esthetics and conservation. Peterson (1947) makes a notable appeal for changing the common names of our North American falcons.

Study Areas

Most of the experiments, and most of the observations on which the next section of the paper is based, were carried out in residential areas of Glendale, Hollywood, and West Los Angeles, California. Kestrels occurring in these districts were using vacant city lots for their winter hunting territories, and the experiments were conducted on these areas. A few experiments also were carried out in rural districts in the vicinity of Castaic, Los Angeles County, California, and on the Mojave Desert between Gorman and Lancaster. No differences were apparent in the behavior of urban and rural kestrels under comparable experimental conditions, but the rural kestrels were wilder and more difficult to work with.

Annual Cycle of Behavior

Before discussing the actual experiments, it will be well to have in mind a brief sketch of the annual cycle of social organization in a kestrel population. There are no definitive studies on this subject, and the statements that I offer are based on my own casual observations over a number of years prior to 1952, and on intensive, year-around studies of 20 kestrels beginning in January, 1953, and continuing to the present.

Courtship.—In southern California mating behavior of most kestrels begins in January, although a few birds may be seen courting and engaging in copulatory behavior in late December. A few kestrels do not begin courtship until late February. Paired birds engage in a long pre-nesting association which is characterized by aerial displays (chiefly by the males), by social hunting by the pair, by courtship-feeding of the female, by mutual preening and billing, by characteristic chittering vocalizations, and by frequent acts of copulation throughout practically the entire period. Copulations become more and more frequent as egg-laying approaches (as many as six in half an hour have been counted) and end within a day after the last egg has been laid. This phase of the breeding cycle usually lasts twelve to fourteen weeks but can be prolonged considerably by a late spring, as was the case in 1954.

Although the pair bond in kestrels is strong, promiscuity is frequent on the part of both sexes. During the courting period adult kestrels appear to be more sociable toward each other than at any other time of the year, and the members of two or more pairs are not infrequently found together on the same area. (See Childs and Mossman (1952) for an account of such an occurrence.)

In one case closely observed by me, this sociability seemed to be directed only toward certain individuals. After a pair under observation had initial territorial conflicts with an intruding pair on their hunting and courting area, and after the female of the territory-holding pair had established complete

dominance over both intruders *by fighting*, the new birds were permitted to share the lot, and promiscuous matings were observed among these four birds. However, other stray kestrels that came to this lot were driven away by both the original and new pairs. The second pair finally took up a separate nesting territory near the end of the courting period, and the original pair was left in sole possession of the lot.

Occasionally during the courting period one finds an extra bird or two, usually a female, associating with an established pair. In January and February of 1954, a lot near the University of California campus was shared by two pairs and four unattached females. Territorial clashes were never seen.

Nesting.—In April or May a nesting site is occupied, usually near the hunting and courting area, but the only area defended during the nesting period is the immediate vicinity of the nest. Encroachments onto the former hunting area do not elicit attack. The eggs hatch in about 29 or 30 days (see Nice, 1954), and the young occupy the nest for about five weeks. The fledged young remain with their parents as a family unit in the vicinity of the nest for a variable time ranging from two weeks to a month or more. During most of this time the young continue to be fed by the parents to some extent. During the late summer the young finally are driven off by their parents, if they have not already strayed away on their own.

Social hunting groups.—Under favorable conditions, the siblings then form a social hunting group and occupy a given area for the rest of the summer. Several broods may band together, and I have seen as many as twenty juvenal kestrels hunting over a single field of 200 to 300 acres. I know of no instance where such an area has been defended by any of the juveniles.

Apparently the juveniles of all North American species of falcons form these hunting groups during the immediate post-nesting period. I have observed such groups of juvenal Peregrines and Gyrfalcons in Arctic Alaska, and twice in interior Alaska I encountered mixed hunting groups of juvenal Sharp-shinned Hawks (*Accipiter striatus*) and Merlins (*Falco columbarius*). Morlan W. Nelson, who is an accomplished falconer and a keen observer of wild falcons, first brought this phenomenon to my attention. He has observed it for a number of years among juvenal Prairie Falcons (*Falco mexicanus*) in Idaho. Mr. Nelson calls the area occupied by such a group the "hunting rendezvous". This social group is maintained until broken up by migration or, in the case of the kestrel at least, by aggressive territory-seeking adults coming into the area in the fall.

The only information concerning the onset of territorial behavior in first-year kestrels is provided by one male that was color-marked as a juvenile and observed continually from July to the following May. Territoriality was first

demonstrated experimentally on January 28 by the release of a trapped kestrel in his area. Previously, such releases had not elicited attack.

The winter period.—In southern California most resident kestrels maintain a permanent pair bond, occupying the same area throughout the year. Some local pairs break up in the fall, and the mates occupy separately-defended areas during the winter. Often their territories are adjacent and near their former nesting sites. A few breeding pairs in southern California leave the vicinity of their nests in the fall and are not seen again until late December or January. How far they move is not known.

The resident population is augmented in the fall and winter by migratory birds from the north and from the higher summer ranges in the mountains. The resident kestrels of urban districts usually constitute no more than one-fourth to one-half the maximal winter population, although the number of immigrants varies a great deal from year to year.

For the purposes of this study, winter territorial behavior is defined as the active defense of a hunting area by a pair or by an individual following the disintegration of the family groups. Most resident pairs begin to show such behavior in the last weeks of August. In migratory birds it begins with their impingements upon the territories of the resident kestrels. Active defense of a hunting area usually ends with the onset of the breeding cycle, and marked territoriality is not again seen until the nesting site is chosen.

Procedure and Methods

In October, 1952, I began systematically recording the occurrence of kestrels in the study areas, locating territorial birds for later experimentation. By the end of the month it was apparent that many individuals consistently occupied the same lots. Birds that appeared to be the same individuals could be found on the same lots—usually on the same perches—at about the same time each day. Different perches, and sometimes different lots, were used at different times of the day. (After nearly three years of observation on individual birds, I can say that the constancy of individual patterns of daily activity is one of the most noticeable aspects of kestrel behavior. Miller's (1954) description of the roosting schedule of a female in this area is an excellent case in point.)

Trapping.—In order to make sure that I was observing the same individuals, I trapped some of the kestrels and color-marked them. Three types of traps were used with about equal success. One was a simplified version of the automatic bow-net recently described by Tordoff (1954). The other two were copies of ancient Persian traps used by falconers. The *balchatri* consists of a wire holding cage for live bait, over the top surface of which are attached slip nooses of lightweight nylon fishing leader. When a kestrel flies

down and strikes the cage, his feet become entangled in the nooses. The *dhogaza* is a lightweight net held vertically between two poles. The edge of the net is laced with a continuous line, the ends of which are attached to the upper ends of the poles. A hawk flying into this net in quest of the staked-out bait pulls the corners of the net loose from their fastenings, and it sacks around the bird. (See Meredith, 1943:442–447, for a complete description and diagrams of this trap.)

Marking.—Since October, 1952, I have trapped and banded forty kestrels. Some of these were color-marked with an acetone-base lacquer (airplane dope) on the dorsal surface of their central rectrices; others were marked by attaching colored jesses (leather leg straps) around their tarsi. The latter method is more satisfactory because the jesses remain intact for a longer time than the painted feathers, which are molted after one year.

A number of these marked birds were experimented with before they were trapped. Subsequent to their being trapped, most of them showed marked alterations in their responses to the same stimulus. Untrapped kestrels did not show such alterations even after many repetitions of the same stimulus. It was soon concluded that trapped birds did not give reliable results in most cases; therefore, all comparable experiments had to be carried out on untrapped birds.

Materials.—A male and a female were trapped and held in captivity for use in the experiments. These birds are referred to hereafter as the "lure-male," the "lure-female," or, collectively, as the "lure-birds." Another male and a female were secured for stuffed mounts. The male was prepared in the normal sitting posture; the female in the copulatory position with up-tilted tail. These birds are referred to hereafter as the "dummy-male," the "dummy-female," or as the "dummies."

The experiments reported below were carried out during the months of November and December, 1952, January, February, March, September, November, and December, 1953, and August, October, November, and December, 1954. The objective was to determine what kinds of response could be elicited from territorial kestrels during the winter by various presentations of the experimental objects on their hunting areas.

Experiments with Live Decoys

In the experiments involving the lure-birds, the procedure first used in 1952 was as follows: one of the lure-birds was tethered to a pyramidal, cloth-screened perch two feet in height from base to apex (Fig. 1). The lure-bird was tied on a short leash so that it could not touch the ground. If it attempted to fly away, it simply fell against the cloth screen on the side of the perch, a

position from which it could easily right itself. When a wild kestrel was sighted, the lure-bird was placed on the perch at a certain estimated distance from the territorial bird. Then the observer retreated, usually to a car or behind some concealing object, such a billboard, to observe. Subsequently this procedure was abandoned for the simpler one of staking the lure-bird on the ground at the end of a four-foot leash.

A great variety of responses was produced by the lure-birds, ranging from apparent indifference to violent and persistent attacks characterized by bodily

FIG. 1. Lure-male on the pyramidal perch near Gorman, California, December, 1952.

contact between the wild bird and the lure-bird. Some descriptions of experiments from my field notes will serve to illustrate the kinds of aggressive action elicited.

On November 13, 1952, at 8:20 a.m., a female that I had been observing for several weeks was sighted on her hunting area. She was perched on a telephone wire at the back of a lot about 50 × 50 yards in extent. The lure-male was set on his perch approximately 20 yards from the female. As I was

walking away from the lure-male in plain view of the female and before I was more than 10 yards distant, the female suddenly launched forth into a diagonal dive straight at the lure-male, passing just a few inches above his head. She made a sharp turn and alighted on the ground about two feet from the base of the lure-male's perch. Then she jumped up and hovered just over the lure-male's head for several seconds, finally flying back to the telephone wire, where she perched and screamed for a short time. Still screaming, she flew to a guy-wire on a telephone pole where she perched about fifteen feet directly above the lure-male. From this point she attacked again, striking the lure-male with her talons and knocking him off his perch. The female flew back to the guy-wire and then repeated her attack, knocking the lure-male off his perch a second time. At the end of this attack, she landed on the ground and sat looking at the lure-male, screaming for several seconds. After this action she flew back to the guy-wire. Again she dived and knocked the lure-male off his perch. By this time the action had been going on for five minutes, and I intervened to prevent injury to the lure-male. There were, however, no cuts or other signs of injury on his body. (I might add at this point that throughout these experiments the lure-birds frequently received blows as severe as the ones described here, but they were never injured in any way, and both were released in perfect condition at the end of the experiments.)

On the same day, at 8:55 a.m., I placed the lure-male in the territory of a male that I had been observing for several weeks. This territory consisted of a vacant lot about 300 × 400 yards in extent with three oak trees growing in it. The male used one of the oaks frequently for a perch and feeding station. At the beginning of this experiment, he was perched on top of a telephone pole on the north side of the lot. The lure-male was set out 100 yards away. There was no action for one or two minutes, the wild male appearing not to have seen the lure-male, which sat still. Presently the wild male flew from his perch and attacked a flock of four Killdeers (*Charadrius vociferus*) that were on the ground about thirty yards from him. He chased these birds out of the lot and disappeared from sight. At 9:00 a.m., I saw this same kestrel flying toward the lot from an unnoticed perch on the side of a hill to the east. He headed straight for the lure-male and hit him solidly with his talons on the first pass. He landed on the ground about three feet from the lure-male and screamed continually for several seconds. Then he began walking around the lure-male in a circle, drooping his inside wing so that the tips of the primaries dragged on the ground. This appeared to be some sort of threat-display. (Other males and females under similar circumstances have shown this same behavior.) After several seconds the male flew into the air again and, making a wide circle, he came in high over the lure-male, 'stooped', and knocked the lure-male off the perch. While the lure-male was dangling

over the side of the perch, the wild male alighted on the apex and sat there screaming. Each time the lure-male tried to right himself, the wild male knocked him back down with a blow from one foot while maintaining his stance on the perch with the other. Occasionally the wild male jumped up and hovered two or three feet above the perch, at which times the lure-male would right himself only to be knocked down promptly by the wild male. After ten minutes had elapsed, I intervened, and the wild male flew to his perch in the oak tree.

On December 8, 1952, I set the lure-male in the area of a wintering pair, at 9:05 a.m. Both wild birds immediately started circling in the air over the lure-male, screaming. In less than one minute the wild male started stooping at the lure-male and striking him with closed fists. The female continued to fly about in an excited manner higher up. She did not stoop at the lure-male. Forty minutes later, when I moved in to retrieve the lure-male, these birds had not lessened the intensity of their actions, except for brief pauses.

On October 17, 1954, at 8:42 a.m., I set the lure-female on the ground in the territory of a resident female. The wild female was 35 yards away. She watched the lure-female intently for a few seconds and bobbed her head up and down. At 8:45 a.m. the wild female flew toward the lure-female, dropped to the ground, and caught an insect about 10 yards away from her. She flew back to her perch on a fence and ate the insect. There was no further action for ten minutes, after which the lure-female was removed.

The same day, at 9:56 a.m., I set the lure female in the area of a wintering female. The wild female was 50 yards away. Immediately she flew down and struck the lure-female a blow with her closed feet. She circled around once more and landed on the ground two feet away from the lure-female. Then she charged in and grabbed the lure-female by her legs, pinning her to the ground on her back. The wild female held the lure-female in this position for several seconds and then flew into the air screaming. She repeated variations of this attack for ten minutes, when I intervened.

Discussion

These five accounts give an idea of the variability of the responses elicited by the lure-birds. Actually no two birds reacted with an identical pattern of behavior, but for the purpose of presenting the data quantitatively, it is convenient to group the results into three categories. Some birds remained on their perches, continued hunting activities, or in other ways showed no change in their behavior when the lure-birds were presented on their areas. Others screamed and dived at the lure-birds, always staying above them and never coming into bodily contact. The most aggressive birds not only screamed and

dived at the lure-birds but also actually struck them with their feet in the air or landed on the ground and grappled their legs, pinning them down.

Tables 1 and 2 summarize the data in these three categories of behavior. Inspection of these tables reveals no differences among the four experimental

TABLE 1

RESPONSES OF FREE-LIVING KESTRELS TO THE LURE-MALE

Experimental Groups	Types of Attack			Totals
	Striking and Grappling with feet	"Stooping" without bodily contact	None	
Single Males	8	3	3	14
Paired Males	10	1	3	14
Paired Females	8	4	2	14
Single Females	11	4	4	19

groups in their responses to the lure-male, but there is a marked difference between the males and the females in their responses to the lure-female. Only one-third of the single males actually came into bodily contact with the lure-female in comparison to about three-fifths of the females which did. None of

TABLE 2

RESPONSES OF FREE-LIVING KESTRELS TO THE LURE-FEMALE

Experimental Groups	Types of Attack			Totals
	Striking and Grappling with feet	"Stooping" without bodily contact	None	
Single Males	4	4	4	12
Paired Males	0	5	5	10
Paired Females	8	2	0	10
Single Females	9	4	3	16

the paired males hit the lure-female, but four-fifths of the paired females did. The difference between the frequencies of all highly aggressive males and all highly aggressive females of table 2 gives a chi square value greater than that required for P to equal the one per cent level of significance.

Experiments Involving Mounted Models

Usually the dummies were set out in the territories on a six-foot rod that was stuck into the ground, but in a few instances they were placed on the ground or on fence posts, and in one case in the top of a pepper tree (*Schinus molle*).

The experiments with the dummies produced a much smaller number of responses. The dummy-male was presented to seven single males, four single females, and one resident pair. None of these birds showed any reaction to the dummy-male. The dummy-female was presented to eight single males, three single females, and two resident pairs. The dummy-female elicited responses three times. One of the females that had been strongly aggressive toward the lure-male during a previous experiment stooped over the dummy-female when it was placed on the ground. On a subsequent day when the dummy-female was set up on the six-foot pole, the same female dived at the dummy and hit it several times in five minutes.

On February 7, 1953, about 4:30 p.m., a male and a female were observed in courting display on a lot that had been the female's hunting area for the past three and one-half months. The female flew out of the area at my approach, but the male remained. I placed the dummy-female in the uppermost branches of a pepper tree growing in the lot. In the meantime the male was flying high overhead. As soon as I retired to watch, the male flew down and hovered just above the dummy-female for several seconds and then flew away.

Experiments with Models and Lure Birds

The experiments involving combined presentations of the lure-male and the dummies revealed some interesting aspects of behavior. In these experiments three different males that had previously shown strong aggressive actions toward the lure-male were used. In the first experiment, in which the lure-male was first presented singly and the dummy-male then substituted for it immediately afterward, the wild male again initiated violent attacks on the lure-male. When the dummy was substituted, the wild male continued attacking it just as vigorously as before and continued to do so for nearly ten minutes, until scared away by a pedestrian.

In the second experiment, the wild male also attacked the lure-male when it was set out alone, but when the dummy-female was presented simultaneously above the lure-male on the six-foot rod, the attacks were switched to her, and these continued in excess of ten minutes. During this time the wild male did not attack the lure-male once, but the dummy-female was hit so hard that its head fell off.

The other experiment of this series occurred by chance. The dummy-male

had been set out 100 yards from a resident male, and there had been no action for about five minutes. Then the lure-male suddenly began screaming the common *killy-killy* cry from his perch inside my car. The resident male immediately answered with a corresponding call and flew directly at the dummy-male, striking it roughly with his talons on the first stoop. Prior to this action there had been no indication that the wild male was aware of the presence of the dummy-male. The lure-male continued to scream at intervals for about five minutes, and during this time the dummy-male was struck many times by the wild male, which displayed even greater aggressiveness than he had shown toward the lure-male in previous experiments.

Discussion

Comparing the results obtained with the lure-birds to those obtained with the dummies, one can say that movement or "aliveness" is a stronger releaser of territorial aggressiveness in kestrels than are form or plumage pattern. This conclusion is also supported by field observations. If a stray kestrel flies quietly into the territory of another bird, and then sits still in a low, inconspicuous place and does not attempt to hunt, the resident bird frequently will not attempt to drive it away; but if the intruder flies about over another bird's territory or attempts to hunt there, it is nearly always attacked.

The last experiment described in the foregoing section shows strikingly the effect of vocalizations on the aggressive behavior of territorial kestrels. Field observations indicate that the *killy-killy* cry is used by resident kestrels to advertise their presence, and frequently this vocalization alone is enough to cause an intruder to leave the area. If an intruder vocalizes, the resident will attack at once.

The differences in the reactions of males and the reactions of females to the lure-female reflects a fundamental aspect of the social behavior of this species. In any social situation involving a pair of kestrels, the male is nearly always subordinate to the female. The female has first right to food taken by herself or by the male. If the male does not present his food to the female, she may take it from him, in which case he does not offer resistance. However, the female does not often enforce her dominance for the food except in the breeding season. The female has first right to favorite perches and roosts. The female accepts or rejects the male in the initial pair-formation, and she releases and controls copulatory behavior. The male inspects a number of nesting sites, but it is the female that chooses the one in which the eggs are laid.

Sherman (1913) is apparently the only one who has recorded detailed observations on the nest-life of the American Kestrel. She presents some

evidence to show that this fundamental difference between the sexes first appears when the birds are nestlings. After the young which she was observing were old enough to feed themselves, the females always ate first and took the most, gaining weight faster than the males. If a hand or a stick was thrust into the nest the males reared back on their tails and opened their beaks, but the females struck out with their feet. I have applied this same test to fledgling Peregrines, Gyrfalcons, and Prairie Falcons and, while the results are not invariable, in general, the same relationship holds for these species. Sherman (1913:410) says, "This yielding of their lawful share of food by the males may have its origin in their disposition in mature life to give the food they bring to their mates." I am inclined to think the statement should be reversed —that the bringing of food to the female and the courtship-feeding of mature life are developments from the social tendencies of nestling life.

It becomes important to learn how much the behavior of males toward their mates is modified by the social milieu of nestling life. For instance, would a brood of all males produce individuals showing the same submissiveness to females that a mixed brood would produce?

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Summary

Winter territoriality is a prominent feature in the behavioral cycle of the American Kestrel (*Falco sparverius*). It functions primarily to maintain an adequate hunting ground for the individual. Experiments employing a captive, adult male, a captive female, a stuffed dummy-female, and a stuffed dummy-male were carried out to study this behavior. The reactions of wild kestrels toward the experimental objects placed in their territories ranged from apparent indifference to the most violent and persistent kinds of attack. There was no measurable difference between the reactions of males and females to the captive male, a majority of both sexes being highly aggressive; females also attacked the captive female as frequently as they did the captive male, but males showed a marked decrease in the frequency of their attacks on the captive female, especially of attacks resulting in bodily contact. This difference between the sexes is the reflection of a masculine submissiveness which has its earliest manifestations during nestling life. A comparison of the results produced by the live captives and the dummies indicates that movements and vocalizations are stronger releasers of aggressive behavior than are form or pattern *per se*.

Literature Cited

Childs, H. E., Jr. and A. S. Mossman
1952 Notes on the behavior of two falcons. *Condor*, 54:207–208.
Howell, T. R. and G. A. Bartholomew, Jr.
1952 Experiments on the mating behavior of the Brewer blackbird. *Condor*, 54:140–151.
1954 Experiments on social behavior in nonbreeding Brewer blackbirds. *Condor*, 56:33–37.
Lehrman, D. S.
1953 A critique of Konrad Lorenz's theory of instinctive behavior. *Quart. Rev. Biol.*, 28:337–363.
Meredith, R. L.
1943 Methods, ancient, medieval, and modern for the capture of falcons and other birds of prey. *In*: The art of falconry. Edited by C. A. Wood and F. M. Fyfe. Stanford University Press. pp. 433–449.
Miller, L.
1954 A sparrow hawk's roosting schedule. *Condor*, 56:230–231.
Nice, M. M.
1954 Problems of incubation periods in North American birds. *Condor*, 56:173–197.
Peterson, R. T.
1947 A field guide to the birds. Revised ed. Boston; Houghton Mifflin & Company.
Sherman, A. R.
1913 The nest life of the sparrow hawk. *Auk*, 30:406–418.
Tinbergen, N.
1948 Social releasers and the experimental method required for their study. *Wilson Bull.*, 60:6–51.
Tordoff, H. B.
1954 An automatic live-trap for raptorial birds. *Jour. Wildlife Mgmt.*, 18:281–284.

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AN APPARATUS FOR MEASURING KINETICS IN AVIAN SKULLS

BY HARVEY I. FISHER AND DONALD C. GOODMAN

In 1867 Huxley distinguished several basic types of construction in the ventral parts of birds' skulls. The structure of these types is in part responsible for the degree of movement (kinetics) at the frontonasal hinge. Despite this early recognition of the mechanism and the possibility of movement, the concept of kinetics here was not extensively explored until the work of Moller (1931), Kripp (1933-1935), and especially Engels (1940). Hofer (1945) dealt with the problem in a functional and quantitative way. Beecher (1951*a*) carried this approach farther. Additional work by Hofer (1950), Beecher (1950, 1951*b*, 1953) and Fiedler (1951) has shown the importance of kinetics, as part of the functional jaw mechanism, in long-term adaptive changes of evolutionary significance.

The studies cited above have, for the most part, been subjective and qualitative. This has caused some concern in our laboratory. We could not find in the literature any measure of the accuracy of judging the degree of kinetics in the skull of a species or any evidence of statistical reliability and variation within a species. Where the kinetic attributes of two different species have been compared, there were no statistical data to support hypotheses of significant or insignificant differences between the two. It would seem that the criteria of variation, reliability, and significance must be established before it is possible to interpret the kinetics in terms of function or adaptive significance.

We failed to see how accurate quantitative data could be obtained following the methods of observation employed by the authors listed. We could find no description of any apparatus that would produce consistent and accurate measurements which could be compared from species to species. This statement is not to be construed as a criticism of these workers; several were interested only in the qualitative, and those who gave quantitative data generally used them as approximations only.

An apparatus was designed to produce quantitative data on this problem and to eliminate, as far as possible, the subjective aspects of past work. This equipment is illustrated in Figure 1.

Description of the Apparatus

The machine is constructed of brass. Therefore the apparatus is sturdy but not great in weight, enabling easy transport to and from the field. This light weight makes necessary the use of a C-clamp (not illustrated) to secure the apparatus to the edge of a table or desk during use.

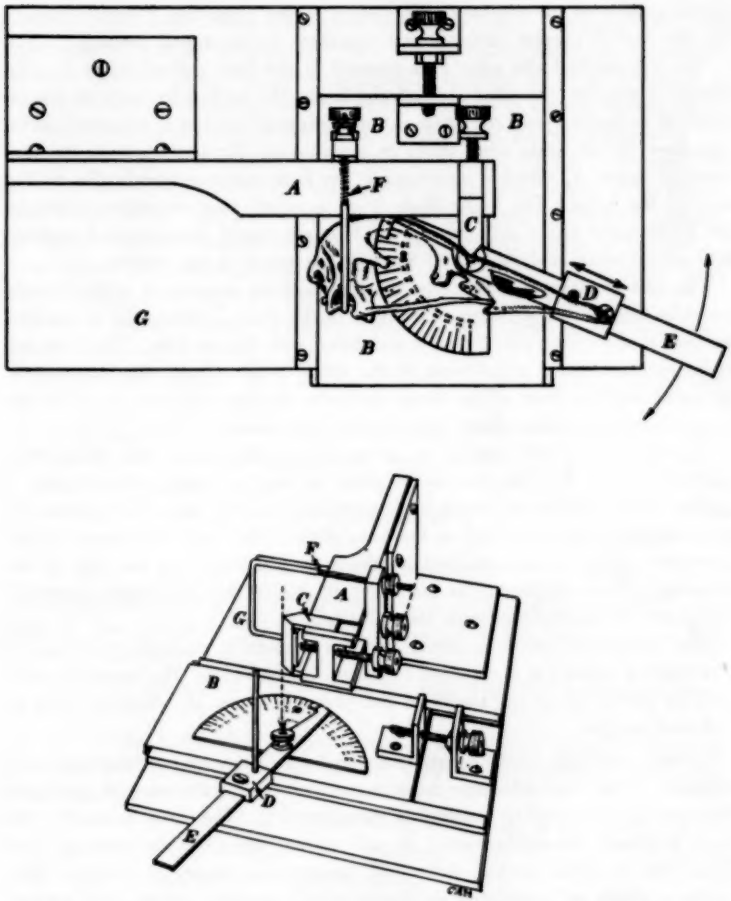

FIG. 1. An apparatus for measuring the kinetics in the frontonasal hinge of the avian skull. Upper figure: top view. Lower figure: oblique end view. See text for details of operation.

Beam A is elevated from base plate G by a wide L-bar. The part of beam A which is free of attachment to the L-bar has been machined into an I-beam. The purpose of the I-construction is to make possible the fixing of clamp F at any point along the length of beam A. It also provides a rest for the convex

dorsal surface of the cranium. The edges of the I provide a sturdy contact for the curved cranial surfaces and eliminate dorso-ventral rocking.

The adjustable knife edge C is located at the free end of beam A. By means of a screw, threaded through the beam, the knife edge may be moved closer to or farther from the beam, accommodating high- or low-vaulted skulls. The base of the knife edge slides in grooves on the upper and lower surfaces of beam A, thereby maintaining the knife edge perpendicular to the axis of the beam. The knife blade is of a length that the entire width of the frontonasal hinge will rest on it. This eliminates dorso-ventral rocking and allows equal distribution of force at the pivot of the system.

The base of clamp F which fits into the posterior depression of the I-beam provides strong and uniform attachment to the beam. Both ends of the rod portion of the clamp are threaded and fitted with thumb nuts. The nuts are tightened for coarse adjustment of the sides of the clamp, but a set-screw threaded into the base of the clamp provides the fine adjustment. The set-screw draws the entire clamp tight against the I-beam.

A protractor of 180 degrees is soldered to a sheet of brass—the sliding protractor plae B. The protractor plate is held to base plate G and is guided in its movement, which is perpendicular to the axis of the beam, by grooved guide bars attached to the base plate. The exact movement of the protractor plate is accomplished by the set-screw shown at the top of the drawing. This adjustment is necessary to insure that the center point of the protractor is directly below the knife edge.

The protractor arm E is fitted with an adjustable vertical extension D. The vertical extension is clamped to the protractor arm. The extension arm may be moved along the length of the protractor arm to adapt for bills of different lengths.

Certain principles in the construction and use of this apparatus merit brief mention. Only two subjective aspects remain. The scale must be read and the hand must be used to manipulate the upper bill. The error in reading the scale is minor; the calibration is in full degrees and so is the reading. The force used to press the tip of the bill upward is a thumb or finger. This pressure might be considered an inconsistently variable feature, but several factors reduce the possible error. With repetition, the user becomes accustomed to the amounts of pressure to be used with the skulls of different species. Then too, in all the species we have thus far dissected, there are ligaments which limit upward motion in the bill. As the bill is pushed upward there is a sudden stop when the ligament is fully extended. We have found, in those forms possessing a basipterygoid process, that the movement between the articular surfaces of this process and of the pterygoid is limited to approximately one-half the length of the articular surfaces. That is, if the two

surfaces are opposite each other when the upper bill is retracted, only half their lengths will be articulating when the ligament halts the movement. Thus, if this fact has been determined for a species, the skull prepared in the usual way for museums may be used. Pressure is exerted on the tip of the upper jaw until the articular surfaces are in the proper position.

A second important feature of the apparatus is its rigidity. All parts are firmly attached, and the bird's head or skull is clamped tightly. The frontonasal hinge, knife edge, and center of arc of protractor are strictly aligned. The clamp and the length of the knife edge prevent any rolling of the skull.

Deflection of the protractor results from pressure on the vertical, fixed arm. No subjective sighting from point to point is necessary.

Parts of the apparatus adjustable for heads and skulls of different sizes are as follows:

1. beam (A)—inserts with smaller grooves may be used for measuring small skulls.
2. knife edge (C).
3. clamp (F)—different lengths and shapes.
4. sliding protractor plate (B).
5. sliding vertical arm (D) on protractor arm (E).

Use of the Machine

1. Adjust the holding-rod of the clamp to grasp the skull immediately anterior to the opisthotic processes. In this position the skull may be held firmly without interference with movable bones.

2. Move the clamp and skull to make the knife edge and frontonasal hinge adjacent.

3. Adjust the knife edge so that when the frontonasal hinge contacts the knife edge the ventral edge of the skull is approximately parallel to the edge of the base plate.

4. Move the protractor center-point by moving plate B so that the center of the protractor arc is aligned with the knife edge. (The skull is tipped forward so that this alignment can be made.)

5. Move the frontonasal hinge into position against the knife edge and adjust the skull in the clamp by use of the set-screw. The correct seating of the skull in the I-beam should be checked; the final adjustment of the clamp must hold the skull tightly.

6. Move the vertical extension arm along the protractor arm so that the extension will conveniently meet the dorsal edge of the upper bill. Use of any point on the bill will produce the same angle, but we chose for the area of contact a point in the distal one-fourth of the bill length.

7. Move the protractor arm so that the vertical extension touches the dor-

sal surface of the bill. The number of degrees indicated on the protractor is the zero reading.

8. Force is applied with a thumb or finger on the ventral surface of the tip of the upper bill until resistance is met. When the orbito-pterygo-palatal ligament is in place, this point of resistance is very definite. A second reading of the protractor is made.

9. The final protractor reading minus the zero reading is the number of degrees that the upper bill has moved.

In the long series of skulls that have been measured in this and other unpublished work, it was found that sufficient accuracy could be obtained by holding the skull in place in the apparatus with a thumb on the basisphenoid plate and fingers grasping the I-beam. This elimination of the adjustment of the clamp permitted more speed in the use of the machine.

Reliability

One of the most important features in the use of any apparatus is constancy in results obtained. That is, what is the error in continuous or discontinuous use when all factors are equal? To test this, one of us measured the kinetics in the head of one Canada Goose, *Branta canadensis interior*, on different days within a period of one month. The head was preserved in embalming fluid with ligaments intact, but the muscles were removed. The head was removed from the apparatus and replaced before each test. The data from this series follow:

Number of trials=66
Mean=17.7 ± .11 degrees
Standard deviation=0.86 degrees
Observed range=16—19 degrees
Theoretical range (M ± 3 standard deviations)=15.1—20.3 degrees
Coefficient of variation=4.9

This information indicates that the mean would lie between 17.4 and 18.0 in 99 of every 100 measurements, no matter how many tests were made. This would be an error of about 3.5% of the minimal mean or, calculated as a part of the observed mean, an error of less than 2% on either side of the observed mean. The error here is that of the machine and its single user.

For the apparatus to be of universal practicability the results should be duplicable by different workers. In a test of this, each of us, independently, measured the kinetics in the same head of a Canada Goose. The head was in the same state of preservation as the head in the first test. The head used in the first test was not used here because we thought there might be some loosening of articulations and stretching of ligaments with prolonged

use of materials hardened in a preservative. The data of the second test follow:

	Observer 1	*Observer 2*
Number of trials	51	51
Mean in degrees	16.0±.16	15.5±.16
Standard deviation	1.17	1.16
Observed range	14–19	13–18
Theoretical range	12.5–19.5	12.0–19.0
Coefficient of variation	7.3	7.5

In each of these series the error on either side of the mean is about 3%. However, the important point here is that the variation between the means of the two series is only 3%. This indicates that different workers can use the machine and obtain comparable results.

Summary

An apparatus was designed to measure the degree of movement (kinetics) in the frontonasal hinge of the avian skull. Several tests demonstrated that the device produced reliable and consistent figures when operated over a period of time by one observer or when used by two different workers.

Literature Cited

Beecher, William J.

1950 Convergent evolution in the American orioles. *Wilson Bull.*, 62:51–86.

1951*a* Adaptations for food-getting in the American blackbirds. *Auk*, 68:411–440.

1951*b* Convergence in the Coerebidae. *Wilson Bull.*, 63:274–287.

1953 A phylogeny of the oscines. *Auk*, 70:270–333.

Engels, William L.

1940 Structural adaptations in thrashers (Mimidae: genus Toxostoma) with comments on interspecific relationships. *Univ. Calif. Publ. Zool.*, 42(7):341–400, 24 figs., 11 tables.

Fiedler, Walter

1951 Beiträge zur Morphologie der Kiefermuskulatur der Oscines. *Zool. Jahrb.* (Anatomie), 71(2):145–288, 25 figs.

Hofer, Helmut

1945 Untersuchungen über den Bau des Vogelschädels, besonders über den der Spechte und Steisshühner. *Zool. Jahrb.* (Anatomie), 69(1):1–158, 30 figs.

1950 Zur Morphologie der Kiefermuskulatur der Vögel. *Zool. Jahrb.* (Anatomie), 70(4):427–600, 44 figs.

Huxley, Thomas H.

1867 On the classification of birds; and on the taxonomic value of the modifications of certain of the cranial bones observable in that class. *Proc. Zool. Soc. London*, 1867:415–472, 36 figs.

KRIPP, DOMINIK V.

1933*a* Der Oberschnabel-Mechanismus der Vögel (Nach den Methoden der graphischen Statik bearbeitet.) *Morph. Jahrb.*, 71:469–544, 45 figs.

1933*b* Die Spezialisationsreiche der Störche, Reiher und Kormorane vom konstruktiven und biotechnischen Standpunkt. *Morph. Jahrb.*, 72:60-92, 22 figs.

1933*c* Beiträge zur mechanischen Analyse des Schnabelmechanismus. *Morph. Jahrb.*, 72:541–566, 11 figs.

1935 Die mechanische Analyse der Schnabelkrümmung und ihre Bedeutung für die Anpassungsforschung. *Morph. Jahrb.*, 76:448–494, 23 figs., 10 tables.

MOLLER, WALTER

1931 Über die Schnabel- und Zungenmechanik blütenbesuchender Vogel. Ein Beitrag zur Biologie des Blumenvogels II. *Biol Generalis*, 7:99–154, 20 text-figs. 2 pls.

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THE HAIRY WOODPECKER IN CENTRAL AMERICA

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THE Hairy Woodpecker (*Dendrocopos villosus*), familiar to nearly every observant person who frequents the woods and fields of temperate North America, is found in the highlands of the warmer parts of the continent as far south as western Panamá. The forms of the species that breed in the mountains of Central America are distinct from those resident farther north, yet all are so similar in plumage and voice that the naturalist who knows any race of the Hairy Woodpecker will at once greet a member of any other race as an old friend. Only after the first warmth of recognition has passed will he begin to think about the differences between the southern bird and its northern relatives. The Central American forms are smaller than the more boreal forms and have the under parts, and sometimes also the white central band along the back, more or less strongly tinged with brown.

In both Guatemala and Costa Rica Hairy Woodpeckers occupy a broad altitudinal belt extending from about 4,000 to at least 11,000 feet above sea-level. At the lowermost of the elevations mentioned they appear to occur only where the mountain slopes are exposed to the prevailing winds and hence unusually cool and humid for the altitude. In the valleys and on the more sheltered slopes they are rarely met lower than 6,000 feet. Near Vara Blanca, on the northern or windward slope of the Cordillera Central of Costa Rica, an excessively humid region exposed to the full sweep of the northeast trade-winds and subject to long-continued storms of wind-driven mist and rain, I found Hairy Woodpeckers abundant at 5,500 feet. Here they dwelt among heavy sub-tropical rain-forests where the towering trees were burdened with an amazing profusion of epiphytic plants of many kinds. These woodpeckers were found in company with Quetzals (*Pharomachrus mocino*), Blue-throated Toucanets (*Aulacorhynchus caeruleogularis*), Prong-billed Barbets (*Semnornis frantzii*), Black-faced Andean Solitaires (*Myadestes ralloides*), and Irazú Grosbeaks (*Pheucticus chrysopeplus*). They usually slept and nested in holes in decaying trees about the edges of the forest or in fire-killed stubs standing in recent clearings. At higher altitudes in Costa Rica Hairy Woodpeckers inhabit heavy forest dominated by huge oaks, and higher still they live amidst the stunted trees near timberline.

In the Guatemalan highlands Hairy Woodpeckers are at home in woodlands of oak and other broad-leafed trees, or among forests composed largely of pine, as well as in the remnants of the magnificent stands of cypress on the high mountain tops. On the plateau of the Sierra Cuchumatanes in the Department of Huehuetenango, I found them on the lightly wooded ridges that rose above the level alpine meadows. Here they were greatly interested

in the pine trees, which at the time of my visit in September, 1934, had been killed in large numbers by some sort of blight. In the neighborhood of 11,000 feet above sea-level they were far less in evidence than were the Guatemalan Flickers (*Colaptes cafer mexicanoides*).

As to the Hairy Woodpecker's way of earning a living, there is little to be written about the southernmost representatives of the species that has not been said a dozen times over for the northern races. They are everywhere the same industrious peckers into dead and dying trees. In Guatemala I watched a female tearing apart old pine cones in search of insect larvae that lurked beneath the scales. There at the higher altitudes the Hairy Woodpeckers roam about the woodlands in the motley flocks of resident and wintering wood warblers, vireos, flycatchers, and other small birds. For some months after the young become independent of parental care, each woodpecker appears to avoid the company of others of its kind, and it is rare to find more than one of them in a flock of other birds. By late November or December, however, they have mated and travel in pairs, either in the mixed flocks or without the company of birds of other kinds.

In voice, too, the Hairy Woodpeckers of Central America resemble their northern relatives. Their most common utterances are a sharp *bip*; a longer, fuller, stronger *beep*; and a rapidly-given, high and clear *bic-bic-bic-bic-bic*—a variant of the picarian rolled note or *churr*. Both males and females beat rapid, rolling tattoos upon resounding dead wood. At Vara Blanca I first heard this drumming about the middle of February.

Sleeping Habits

At Vara Blanca I found ten dormitories of Hairy Woodpeckers. These woodpeckers invariably slept alone; but in August two females, probably young birds, occupied lodgings only ten feet apart in the same low stub in a pasture. The doorway of the lower was only as high as my head. From early August until the following February or March, another female slept fifteen feet up in a rustic post that supported a telegraph wire beside a muddy mountain road. Tame and confident, she was not frightened from her low dormitory by travellers passing before her doorway. Her tenancy of over six months was terminated only by the fall of the decayed pole. Other Hairy Woodpeckers that slept in low holes were equally fearless, and would at times enter while I stood watching at a distance of only three or four paces. Indeed, in these mountain fastnesses still scarcely invaded by man, the birds as a whole were easier to approach and to watch than I have ever found them elsewhere.

A male Hairy Woodpecker occupied the same hole in a high stub at the forest's edge from September until at least the end of the following January;

in February the stub fell. Although I found seven dormitories of female Hairy Woodpeckers and only three of males, the two newest cavities were occupied by males; and the only hole that I actually saw being made, before the start of preparations for egg-laying, was carved out and used for sleeping by a male. Some of the chambers in which the females roosted were very old and dilapidated, with chinks in the walls. The males of the Red-crowned Woodpecker (*Centurus rubricapillus*) also carve holes for sleeping at seasons when I have not known the females to interest themselves in this activity, and they sleep habitually in dormitories sounder than those occupied by the females. Like other members of the family, these Hairy Woodpeckers retired early, especially on rainy evenings, and became active late in the morning.

Settlement of Disputes

Most kinds of woodpeckers are 'territorial' birds, and it is rare to find two nests of the same species in sight of each other. But as a rule the boundaries between territories are agreed upon by methods that elude the bird-watcher. Once, however, I witnessed a dispute between two male Hairy Woodpeckers, which apparently were endeavoring to settle some difference over boundaries or conflicting claims to land. The scene of this debate on April 18, 1938, was the pasture below the cottage which I occupied at Vara Blanca. Here there were a number of dead trunks close together, and fallen dead branches, portions of which rose above the herbage that covered the ground. The two antagonists clung to a thick branch, or to the side of a trunk near its base, a foot or two apart, and thrust forward their heads until body, neck, head, and bill all lay very nearly in a straight line. In this posture they twitched their bodies rapidly up, down, and sideways, a performance which they continued together for a few seconds; and when one ceased the other did likewise.

Then they would prance about, or come as near to prancing as is possible on a surface that is vertical or almost so, both at the same time, for a period of several seconds. Next, perhaps, one would fly over the other and cling to the trunk an equal distance on the other side of his opponent; and, with the relative positions of the actors reversed, the play would proceed much as before. After a while, tiring of these antics, the two woodpeckers would rest for a minute or two, only a foot or two apart. Then one of the twain would fly to a nearby trunk or branch, and soon the other would follow. As the second came near the first, the latter would sometimes spread his wings in a defensive attitude, prettily displaying the black and white bars on the lower surfaces. Here on this new stage the play continued in the same fashion. Only rarely did one bird actually come into contact with the other as the two pranced about and flew over each other; and then they barely touched, in the lightest and most inoffensive manner.

Thus the mimic warfare moved from one trunk or branch to another, then back again to the first, always keeping near the ground and rarely rising so much as ten feet above it. Perfect silence was preserved by the contestants, who seemed quite oblivious of my watching so close to them. For nearly an hour this elaborate play continued, with alternate periods of activity and motionless repose, while the two protagonists clung possibly a foot apart in amicable truce. Surely, two opponents who rested so quietly almost within each other's reach could not have been bitter enemies! At last they wearied of this monotonous game and went off to attend to other business. Like so many of the conflicts of birds, theirs had been of a purely formal nature, and was not attended by the loss of so much as a single feather on either side.

Nest-Building

Above Tecpán in the Guatemalan highlands, at an altitude of nearly 9,000 feet, I found the members of a pair of Hairy Woodpeckers working alternately at a newly begun hole, evidently destined to contain eggs. This occurred on February 7, 1933, at the height of the dry season. On March 21, in the same locality, I discovered another hole which apparently already held nestlings. At Vara Blanca, Costa Rica, the first preparations for nesting were noted on March 3, 1938, when I watched a pair just beginning to carve a hole. This was never completed, possibly because they found the wood too hard toward the center of the trunk; but a neighboring pair was incubating by March 28. This was at the driest time of the year in an excessively rainy region which had no real dry season. The Hairy Woodpeckers in both Guatemala and Costa Rica nest earlier than the majority of the birds which surround them, although not so early in the year as some other woodpeckers.

The seven nest cavities that I have seen in Central America were in dead trunks or posts, either in the woodland or in clearings not far beyond it. In height they ranged from 11 to about 60 feet above the ground. The lowest was in a telegraph pole beside a mountain road—not the one in which the female slept but in the same line. Another was about 15 feet up in a dead stub in a pasture; the highest, at 60 feet, was also in a dead tree in a pasture.

Male and female work alternately at carving out the nest-cavity. Sometimes each continues the task rather steadily for 25 or 30 minutes, but often the period of labor is considerably shorter. When the mate arrives to take over the chiselling, the one which has been at work flies promptly away to forage at a distance, instead of lingering close by while the other works, in the manner of trogons, puffbirds, jacamars, barbets, and motmots. One pair which I watched carving a hole in April, to replace another they had lost, dawdled at their task through the early morning, but at about ten o'clock set to in earnest and continued until noon. Another pair also toiled hard

through the middle of the day. The loosened chips were always dropped to the ground beneath the doorway, never carried away This orifice is from 1⅝ to 1½ inches in diameter.

Incubation

Upon its completion, one of the two Hairy Woodpecker nests accessible to me was stolen from the woodpeckers by a pair of Blue-throated Toucanets. After enlarging the doorway, the toucanets began nesting in this cavity. The other woodpecker nest within reach of a ladder (11 feet up in the telegraph pole), contained three white eggs when found on April 16. This is the only Hairy Woodpecker's set from Central America of which I have knowledge. During the day male and female incubated alternately; by night the male alone occupied the nest. One morning at dawn I saw the female come to replace her mate on the eggs; but he, not caring to leave so early, repulsed her with pecks from the doorway. He lingered in the nest for 34 minutes longer, or until 6:14 a.m. when, hearing the female call *bip* in a neighboring tree, he flew forth. Seven minutes later she entered to incubate.

The Young

In the nest in the telegraph pole only a single egg hatched, on April 24. The pieces of empty shell remained at least two days in the nest. The nestling was perfectly naked and had tightly closed eyes. Like other woodpeckers, it bore at each corner of the mouth a prominent white knob, the pair of which apparently help to guide the parents when delivering food in the dimly lighted cavity. The little one was fed by both parents with food carried in the bill, from which at times parts of insects projected and were easily seen. Both took turns at brooding the nestling during the day, but the male alone kept it company through the night. When the nestling was six days old its pin feathers began to sprout. At the age of 17 days it was partly feathered and already displayed a patch of red on the head. When three weeks of age it was well clothed with plumage and rather closely resembled its father.

By his tenth day the young woodpecker had become quite vociferous and cried much in a high-pitched voice when a parent visited his nest. By the time he was feathered he delivered with rapid repetitions a sharp, clear, metallic note, and also uttered the churred call of the adults. When 26 days old he began to look out through the doorway and call for food with a sharp *bip* or a rapid series of such notes, only slightly weaker than the corresponding notes of the adults. The parents now passed food to him while they clung outside. Except at meal-time, he was now less noisy than he had been

a few days earlier. Both parents removed the droppings and kept the nest perfectly clean for at least 17 days after the nestling hatched. But about the time the youngster became clothed with feathers they relaxed their attention to the sanitation of the nest, which rapidly became foul on the bottom. Before the young woodpecker departed, the waste matter had accumulated to a depth almost sufficient to bury an unhatched egg that still remained in the nest.

This young Hairy Woodpecker flew from the nest on May 22, at the age of 28 days. While I watched that afternoon, his father from old habit came to the post with a long larva dangling from his bill. Not finding the youngster at home, he called and, receiving an answer from the neighboring thicket, flew off in that direction with the food. Neither the father nor the fledgling came that evening to sleep in the nest-cavity, which thenceforth remained deserted.

From the nest 60 feet up in the tall dead trunk standing in the pasture, I watched the last fledgling, a male, make his exit at eleven o'clock on May 8. He flew very well and descended to a small yos tree that stood down the slope from the nest. Here he climbed about and pecked at the bark just as though he had been long accustomed to these activities. Both he and his brother wore red patches on the head, brighter than those of their father, whose plumage was worn. (Although both youngsters were apparently males, the tendency of young woodpeckers of both sexes to resemble the adult male rather than the adult female, casts some doubt upon this point.) Later that afternoon I found the family, consisting of the parents and these two fledglings, at the edge of the woods about a hundred yards from the nest. Because of the low cloud-mist and the drizzle that fell from it, I could see little of them; and it was hopeless to try to follow their movements. But I watched the empty nest. At six o'clock the father flew up alone and entered it. The youngsters apparently remained out in the rain, which was now falling steadily.

Late in the afternoon of the third day after these young woodpeckers left the nest, I again found them with their parents on a dead trunk near the nest-tree. The youngsters hammered at the decaying wood and picked up particles which apparently were not good to eat, for they were dropped. But at least they already tried to find food for themselves, only three days after sallying from the nest. They flew back and forth between the trunks with surprising speed. I decided to try once more to learn where they passed the night.

At 5:45 p.m., when the sky was dark with clouds and a drizzle fell, the mother of the family entered a hole in the top of a living guarumo (*Cecropia*) tree. These trees have slender trunks with a wide central hollow, often in-

habited by ants; and although I had often seen woodpecker holes in both living and dead trees of this genus, I had never before known any use to be made of them by the woodpeckers. They are apparently rarely if ever occupied as nests, but this Hairy Woodpecker showed me that they sometimes serve as dormitories.

Then the father vanished, evidently to sleep in the nest-cavity, as he had done three nights earlier; but this opened on the side of the trunk facing away from me and I could not see him enter. The two fledglings continued to climb over the trunks in the slow rain and the waning light. Although there were numerous old and unoccupied holes made by woodpeckers and barbets in these trunks, one of them in the guarumo tree directly below that into which the mother had retired, the youngsters took no notice of them. I lost sight of one of the young woodpeckers while keeping my eyes upon the other. As the light failed, he ascended to the top of a tall tree and climbed restlessly over its branches, pecking here and there, and taking special interest in a shallow hollow in the midst of a small cushion of moss. Still, he did not sleep in this. At length he settled down, clinging upright to an upright bough, just beneath a horizontal branch that grew out from it. These branches were themselves thin, but the moss that enveloped them afforded the young woodpecker a degree of shelter from the raindrops that fell vertically. But he was unprotected on three sides and exposed to all the winds that blew that stormy night. Meanwhile his parents slept not far off in their snug quarters. They showed exactly the same indifference as to how their youngsters passed the night that I had found earlier in Red-crowned Woodpeckers. What a contrast between this neglect and the careful attention which Golden-naped Woodpeckers (*Tripsurus chrysauchen;* see Skutch, 1948. *Auk*, 65:225–260) and Olivaceous Piculets (*Picumnus olivaceus;* Skutch, 1948. *Ibis*, 90:433–449) give to their fledglings' comfort for the night!

Summary

The Hairy Woodpecker is resident in the highlands of Central America, chiefly between 4,000 and 11,000 feet above sea-level. In the Guatemalan mountains a single woodpecker is often to be found in a mixed flock of small birds in the late summer and autumn, but before the end of the year these woodpeckers have mated and travel in pairs.

Ten dormitory holes were found in Costa Rica. Adults, except males attending nestlings, always slept alone. Some of the females occupied chambers which were very old and dilapidated. The males used newer holes, and the only sleeping cavity actually found under construction was the work of a male.

A dispute between two males was settled by much displaying and posturing but no actual fighting.

In February or early March the woodpeckers begin to prepare their nest chambers, which are carved by both sexes working alternately. One hole was no sooner finished than a pair of Blue-throated Toucanets took it from the woodpeckers.

Laying begins about March, and one set of three eggs was examined. Male and female alternate incubating the eggs by day but the male alone attends them through the night. He also broods the nestlings by night.

Both parents feed the nestlings on insects and larvae brought in the bill rather than regurgitated as with some other woodpeckers. For the first 17 days or more one nest cavity was kept perfectly clean, both parents carrying away the droppings. But after the nestling was feathered, the sanitation of this nest was neglected.

A lone nestling flew from the nest when 28 days old. Neither this bird nor a parent returned to sleep in the low nest cavity. After two other young woodpeckers left a very high nest, the father returned to roost in this cavity; the mother retired at nightfall into a neighboring hole, but the youngsters were left out in the rain.

San Isidro del General, Costa Rica, May 5, 1954

COMMENTS ON SOME RECENT STUDIES OF SONG BIRD PHYLOGENY

BY ERNST MAYR

THE classification of the families and orders of birds, particularly that of the song birds, was until recently one of the most neglected branches of ornithology. For fifty or seventy years little progress had been made in this field except for the occasional reassignment of a doubtful genus or for a reshuffling of the sequence of families. In recent years a newly awakened interest in bird anatomy has led to studies which have resulted in a number of stimulating publications. Two of these have been selected for discussion here. A critical evaluation of the methods and principles underlying such studies is urgently needed in order to point out potential pitfalls to other investigators engaged in similar work.

TORDOFF'S STUDIES OF THE BONY PALATE

The objective of Tordoff's (1954*a*) study is specific and his method straightforward. It starts from the well-known work of Sushkin, who divided the finches into a number of subfamilies (Cardinalinae, Emberizinae, Carduelinae, etc.), each diagnosed by characters of the horny and bony palates. Tordoff attempts to ascertain whether these subdivisions are well founded, whether some of them are more closely related to each other than to others (in fact, whether "the finches" are a natural group), which other families are closely related to the finch group, and where some of the genera that have not previously been assigned to any of the subfamilies belong. To answer these questions he studied the bony palate in representatives of about 175 genera of finches and related families. The number of differences in the palate which are not largely determined by functional needs is small. The principal object of such a study, in fact, is to find out which of the similarities are functional adaptations and which are due to common descent. As far as the palates of finches are concerned, Tordoff decides that the presence or absence of palato-maxillaries is the most crucial character, in conjunction with the conformation of the pre-palatine bars. On the basis of these characters, Tordoff concludes that the finches consist of two unrelated assemblages, the carduelines (goldfinches, purple finches, etc.) on the one hand, and all the remaining ones (true finches, buntings, cardinals, etc.) on the other. (The term "bunting" throughout this discussion refers to any emberizine finch, including the American "sparrows," towhees, and juncos. The members of the genus *Passerina*, called buntings in America, belong to the subfamily of cardinals.)

Tordoff presents good evidence to indicate that the Carduelinae are related to the weaver finches (Estrildinae). By a happy coincidence, Prof. H. Steiner of Zürich was working concurrently on a similar problem. He reached the same conclusion independently on the basis of a study of the Estrildinae (work presented at the International Ornithological Congress at Basel in June, 1954). Steiner showed that the "Ploceidae" of textbooks are, like the finches and as suspected previously by Chapin, an artificial group, consisting of true weavers and the unrelated weaver finches. Tordoff and Steiner find that the association of Carduelinae and Estrildinae is supported not only by anatomical, but also by life-history data.

Tordoff finds characters of the bony palate of the chaffinch genus *Fringilla* which seem to him to justify its exclusion from the cardueline complex and its association with the Emberizinae. This taxonomic disposition of *Fringilla* is not entirely satisfactory. There is in the chaffinch a cardueline resemblance in plumage coloration and bill structure, in the gape color of nestlings (similar to that in *Coccothraustes*), and in nest structure (finely woven). *Fringilla* also differs from the usual emberizine pattern in the color of the eggs. Sushkin (1925:256) believed that the characters of horny and bony palates indicated relationship of the chaffinch with the Carduelinae. It would seem far better not to combine *Fringilla* with the buntings but to retain for this genus a separate subfamily. Tordoff is right in keeping it separate from the carduelines, from which it differs not only in the stated osteological characters but also in the apparent absence of a crop.

Tordoff's findings concerning the cardinals, buntings (as defined above), and tanagers are as follows: No sharp line can be drawn between emberizids and tanagers, as far as skull structure is concerned. This parallels the findings of the bird skin taxonomist, who had long been in doubt as to where to place certain genera. By drawing an arbitrary line between genera with free and those with fused palato-maxillaries, a sharp separation can be made between cardinals and buntings. Yet this forces one to assign quite a few genera to a different subfamily from that in which they had been placed on the basis of plumage characteristics. Regardless of possible shifts of genera on the basis of other characters, the essential fact of the very close relationship of the New World finches and the tanagers is well established. (Tordoff found no characters which would justify separating Darwin's finches from the subfamily of buntings.) It is likewise clear that the Icteridae, Parulidae, and Vireonidae belong to the same general assemblage of families.

What is still in doubt is the direction of evolution. At first sight it would seem simplest to accept as ancestral a type with an unspecialized bill (such as that found in certain tanagers and vireos) and to derive from it the two specialized finch types (cardinals and buntings), as well as the various more

extremely specialized insectivorous and nectar-feeding types. This solution is rejected by Tordoff because it would require the repeated independent origin of fully-developed, functional palato-maxillaries, as well as an explanation for the occurrence of fused palato-maxillaries in groups where they seem to have, at present, no functional significance. As a consequence, Tordoff postulates that some cardinal-like finches were the ancestors of all New World nine-primaried song birds (including icterids, vireos, wood warblers and honey-creepers), which subsequently lost free palato-maxillaries. This is a tenable hypothesis, and yet it raises so many awkward phylogenetic problems that one should keep an open mind concerning an alternative hypothesis. The fact that many thick-billed seed-eaters (Ploceidae, Carduelinae) lack the palato-maxillaries indicates that such a structure is not a functional necessity and develops only where there is a predisposition for it. Perhaps this potentiality has an embryological cause (a separate ossification center?). The textbooks of comparative anatomy and paleontology list literally hundreds of instances where a potentiality in a group is realized independently a number of times. This does not constitute polyphyletic origin because the character is in each case produced by essentially the same gene complex. Perhaps the fused palato-maxillaries condition is a rudimentary trait and not an indication of obsolescence. It is difficult, in the absence of fossils, to decide which way to read such a morphological series. The rich development of insects during the Cretaceous makes it hard to believe that the principal insect-eating birds of North America would have evolved so late, and as descendants of finches, at that!

Tordoff's study is an important contribution to our knowledge of the structure and relationships of passerine birds. The evidence is clearly presented throughout, and where it causes difficulties, this is not glossed over, but discussed in detail. The 77 drawings of bony palates permit a rapid check of the characteristics discussed, even if one does not have access to specimens. It is improbable that the author's modest warning will prove justified: "Further studies of structures other than the bony palate may show that many conclusions expressed here must be modified." Rather, it seems that Tordoff's essential conclusions are sound and will be substantiated further.

Beecher's Studies of Jaw Musculature

Far more ambitious than Tordoff's investigation of the bony palate of finches is Beecher's work of the past several years, devoted primarily to the arrangement of the jaw muscles of birds. It has resulted in the publication of a series of papers culminating in a new phylogeny of the song birds (Beecher, 1953). Beecher's concepts of the phylogeny and classification of

the song birds differ so drastically from previous theories and arrangements that a critical analysis of his findings and interpretations seems to be in order. This has already been done in part by Tordoff (1954*b*), with particular reference to Beecher's conclusions regarding the New World nine-primaried oscines. Yet, in view of the growing interest in bird anatomy, I feel that there is need for a broader evaluation and, in particular, an *analysis of the principles* by which Beecher has interpreted his findings.

The broad basis and the importance of Beecher's work is indicated by the fact that he dissected the jaw muscles of nearly one thousand specimens belonging to more than six hundred species. On the strength of his anatomical findings he suggests a new placement for many genera, subfamilies, and families, leading in many instances to a considerable improvement of avian classification. His argument (1951*b*) that the Coerebidae are a polyphyletic group consisting of superficially similar flower-visiting wood warblers and tanagers seems convincing and is consistent with the plumage characters and palatal structure of the respective genera. Worthy of special attention are his suggestions (1953:281) of placing *Oxylabes*, *Prunella*, *Thamnornis*, and *Zeledonia* with the Saxicolinae, the Mimidae near the thrushes (p. 282) rather than the wrens, *Tylas* and *Hypositta* with the Vangidae (p. 298) and the Vangidae near the Prionopidae (p. 298), while separating the monarch flycatchers (Monarchinae) from the true flycatchers (Muscicapinae).

Especially valuable features of Beecher's studies are the utilization of a new set of characters (the jaw muscles) and his presentation of numerous semidiagrammatic drawings which permit other workers to make their own interpretations of his data. (It is difficult to evaluate how diagrammatic these drawings are. Some of the jaw muscles are interlaced in a rather intricate manner, and in some of my own dissections I have been unable to establish the clear patterns shown in Beecher's diagrams. This may be due to lack of aptitude on my part.)

It is possible, if not probable, that interpretations very different from those of Beecher might be made. Indeed, the past history of phylogenetic researches reveals how often different authors have come to diametrically opposite conclusions on the basis of the same evidence. Evidently, this field is full of intellectual pitfalls. Before accepting Beecher's drastic proposals, let us first see on what assumptions they are founded. Although most of these are only tacit in Beecher's publications, they so clearly underlie his reasoning and interpretations that it does not seem unfair to clarify the discussion by stating them succinctly.

ASSUMPTION 1.—*An established morphological series equals a phylogenetic*

series; simple structures are primitive, and more complex structures are derived from them secondarily; morphological trends are irreversible.

This tripartite assumption applied to the jaw muscles of song birds leads Beecher to the following conclusions: Since the parallel-fiber type of muscle (with a terminal attachment of tendons) is morphologically simpler than the pinnate type in which fibers are attached laterally to a longitudinal central tendon, the higher the proportion of parallel-type jaw muscles, the more primitive the species. Therefore, the families of song birds can be arranged in a series or several series according to the increasing proportion of pinnate jaw muscles. This morphological series equals a phylogenetic series. Beecher's entire new arrangement of the song birds rests essentially on this basis.

I believe that this basic assumption, as well as the taxonomic conclusions drawn from it, are wrong. In groups like the mammals and the reptiles, in which there is good fossil material available, it has been shown again and again that a morphological series is not necessarily a phylogenetic series. In fact it is of almost regular occurrence that a structure begins in a simple condition, becomes complex later in its evolution, but is eventually again simplified. The more important a structure is functionally, the more plastic it will be in evolution.

Specifically, there is no evidence whatsoever that a high proportion of parallel jaw muscles is an indication that a given genus of song birds is primitive.

Unfortunately not much is known about the relative frequency of parallel (longitudinal) and pinnate jaw muscles among the lower vertebrates or in the older orders of birds, but this much is certain, that pinnate muscles are an ancient invention. They occur where heavy traction is needed between two bones that are in close proximity. Thus they have a clear functional significance. Since functional characters, especially those connected with feeding habits, are known in many instances to have reversed the direction of their evolution, it is highly presumptive that the development of jaw muscles in birds has also done so at times. It is highly probable that many of the ancestral song birds fed on a mixed diet and had a generalized equipment of parallel and pinnate jaw muscles, and that from this primitive condition there have been various specializations either in the direction of more parallel muscles or toward more pinnate muscles and probably back again in many cases. If this is true, then a modern pattern of jaw musculature consisting almost exclusively of parallel muscles is as specialized as the reverse. It might be added, incidentally, that it is quite impossible to draw a sharp line between parallel and pinnate muscles—intermediate stages occur frequently.

Beecher seems to have been influenced in his reasoning by "Dollo's Law" of the irreversibility of evolution. Although this law is valid as far as the

broad history of the earth is concerned, it is by no means always true when single organs or evolutionary trends are concerned. Indeed, evolution often is reversible, particularly when strong selection pressures exist and genetic systems are essentially the same, as in close relatives. (For a discussion and further references, see Huxley, 1942:501–503 and Simpson, 1953:310–312.) The application of "Dollo's Law" to such a plastic structure as the jaw muscles within such a closely knit assemblage as the song birds is certainly misleading.

ASSUMPTION 2.—*The pattern of jaw muscles is constant within a given family; function does not vitally affect muscle pattern; similarity of muscle pattern therefore proves close relationship.*

Beecher is aware of potential objections to this assumption and cites therefore the family Icteridae, with its varied feeding habits. He dissected all of the more divergent genera without finding any major deviation from the basic pattern of the jaw muscles (Beecher 1951*a*). Yet, this point is not convincing. To begin with, the bills of the Icteridae are not sufficiently different in form and function to prove that adaptive radiation could not induce shifts in muscle pattern within a family. Indeed, if Tordoff (1954*a*) is right in stating that the Dickcissel (*Spiza*) is a cardinal, rather than an icterid as demanded by the muscle pattern, the basic premise is weakened considerably.

Furthermore, every student of the higher categories knows that a given character may be highly constant in one group and highly variable in another. Perhaps the muscle pattern is relatively constant among members of the Icteridae, but quite variable within the other families? Beecher himself cites abundant evidence to prove that this is indeed the case. He proposes (1953:278): "A major phylogenetic division of oscinine families . . . largely on the basis of the parallel or pinnate character of adductor slip *M7b* [*M. adductor mandibulae externus medialis*]." Yet, scattered through his account are numerous examples of variation in this muscle, as well as in "*M7a*" (*externus superficialis*), within a single family. For instance, in 25 per cent (two out of eight) of the vireos, *M7b* is not parallel, in spite of the fact that the functional difference is very slight; *M7b* is parallel in *Motacilla citreola* but pinnate in the remaining motacillids; it is usually pinnate in the wood warblers (Parulidae) but is parallel in the broad-billed genera *Setophaga, Myioborus,* and *Basileuterus.* These do not appear to be the most primitive genera of wood warblers, Beecher's assertion to the contrary notwithstanding! In the family group diagnosed (p. 278) as having a pinnate *M7b* are several families, such an tanagers, cardinals, and Carduelinae in which it is stated in the text: "*M7* (not *M7b*) pinnate." The muscle pattern is

highly diverse in the Honey-eaters (Meliphagidae, p. 301) and the Hawaiian Honeycreepers (Drepaniidae, p. 312), so that these families surely would have to be broken up if muscle patterns were decisive. Tanagers and cardueline finches intergrade imperceptibly in their muscle patterns, but are not closely related on the basis of other criteria. Here, obviously, parallelism is involved, as also in the case of the finch-like Drepaniidae with their extraordinary resemblance to carduelines. The embarrassing frequency of a parallel *M7b* in groups that "should" have it pinnate induces Beecher to say with respect to the wren-creeper-titmouse assemblage (p. 315): "*M7b* might be considered parallel but not in the same sense as in Sylvioidea." In what sense then, one might ask (since Beecher's attempt at an answer in subsequent sentences is no solution)?

A close study of the variation in these muscles shows how closely they are correlated with function. One can establish quite a consistent functional series from the weak-billed insect-eaters through the stronger-billed shrike-flycatchers and shrikes to nectar-, fruit-, and seed-adapted or omnivorous groups. These latter "are in every way more complex, with increased pinnate musculature, stronger bills, more intricate palate relief, a tendency toward double ectethmoid foramina . . ." (Beecher, 1953:278). Only there is, contrary to Beecher's contention, no evidence that this functional-morphological series is a phylogenetic series. Beecher admits the artificiality of groups like "finches," "shrikes," and "flycatchers," based on the form of the external bill, but precisely the same criticism can be raised against the use of internal functional characters. Pinnate muscles are clearly correlated with powerful biting action and heavy jaws or other functional adaptations (nectar-feeders), in contrast to the largely parallel jaw muscles of the thin-billed groups. Even Beecher seems occasionally unable to escape the force of the evidence which shows that the jaw muscles, like all other functional characters associated with food intake, may be subject to rapid evolutionary changes and convergences, hence to polyphyletic groupings. He admits for certain slender-billed babblers (Timaliidae) that (p. 313) "in them the pinnate character of *M7b* has virtually disappeared as it has in many honey-eaters and in the true wrens."

ASSUMPTION 3.—*A valid phylogeny and classification of the oscines can be erected on the basis of a single character, the pattern of variation of the jaw muscles.*

In spite of his protestations to the contrary, Beecher (1953:276) cannot escape the fact that he has built the imposing structure of a new phylogeny of higher passerine birds essentially on a single character, namely on a few

variations in a set of seven jaw muscles. There is so little potential variation among the functionally possible patterns of these muscles that much similarity is quite inevitable. Other characters cited by Beecher, such as the sculpture of the horny palate, and the shape of the tongue and that of the bill, are functionally so closely correlated with each other, and with the jaw muscles, that they certainly cannot be regarded as four independent characters. From the point of view of selection pressure they are a single-character complex, even though some basic potentialities may not be affected (for example, bifid vs. trifid tongue).

Additional characters used by Beecher, such as the formation of the ectethmoid foramen and the shape of the lacrimals, do not seem to contribute much to our understanding of oscinine relationships beyond showing that some families differ from each other in these characters. The character of plumage coloration must be singled out for a more detailed discussion. In recent decades plumage characters have been found to be conservative in many birds, and it is quite in order for Beecher to utilize plumage patterns. In so doing, however, he makes questionable suggestions, for example (p. 284), that close relationship between swallows and starlings is corroborated by the fact that in both groups streaked plumage occurs in both immatures and adults, as well as iridescent black plumage in adults. The widespread occurrence of such patterns of plumage in other orders and in other passerine families clearly renders the character useless taxonomically. Equally questionable are the suggestions (p. 288) that the bare nape of bulbuls may be "associated with" the naked nape of certain birds of paradise and that the long nape "hairs" of bulbuls may be the forerunners of the specialized plumes of the paradiseids and hence endorse their relationship! Likewise Beecher's statement (p. 289) that the variable black and white plumage of the bulbul *Microscelis madagascariensis* suggests that of the Corvidae is not convincing.

It would seem advisable to use color pattern as a clue to relationship only when it can be evaluated carefully. A color character which is maintained without or against selection pressure, is highly valuable phylogenetically. For instance, the white spots in the tail feathers of the crag martins ("*Ptyonoprogne*") of Eurasia and Africa indicate their close relationship with *Hirundo*, an association which is also supported by voice and by nest structure. The sandy coloration of the desert-living *Ptyonoprogne*, however, is a character that has developed under high selection pressure and is of low phylogenetic value. A cryptic general coloration of sandy brown with a disruptive pattern of dark shaft streaks occurs in so many non-passerine and passerine families of grassland birds that it is obviously of no use as an indicator of relationship. Nevertheless this color pattern is used by Beecher to support his association of larks, pipits, and cisticolas (1953:314). White bellies, or black breast

bands likewise are so widespread among birds that they are virtually useless as phylogenetic clues.

It has become almost axiomatic in modern taxonomy to accept that classification as the best which is based on the greatest number of characters. But quantity alone is not decisive. Such characters must also be weighed. It is often stated that taxonomy is an art. This is to some extent true. The art consists in the proper weighing of characters. The validity of many recent classifications has been greatly strengthened by the generous reference to habits and other biological characteristics. Unfortunately, even biological characters are not immune from convergence. This is evident from the occurrence of domed or pendant nests in many unrelated groups of birds or the "teetering" of spotted sandpipers and wagtails. Such characters are of value nevertheless when used in combination with others, particularly in order to place an ambiguous species or genus. They are of very dubious value when used to support the association of otherwise dissimilar families, such as the true wrens (Troglodytidae) and the Australian warblers (Malurinae) because both have the habit of "carrying the tail over the back" (Beecher, 1953:317).

ASSUMPTION 4.—*A phylogenetic tree can be devised on the basis of a morphological progression of contemporary families.*

This basic flaw in Beecher's philosophy of phylogeny has by implication already been exposed in part above (see Assumption 1). Tordoff (1954*b*) points out that it induces Beecher to push the origin of living families of birds, such as the vireos, back to the Cretaceous. At that, Beecher derives the vireos through the monarch flycatchers from the grass warblers, which therefore ought to be much older still!! Although specialized families often seem to have a higher evolutionary rate than more primitive ones, there is no evidence available that would favor Beecher's extreme interpretation. Indeed it seems improper to use the term phylogenetic tree for a morphological series as presented on his fig. 18 (p. 324). Phylogenies can be established only by unequivocal evidence from comparative anatomy or by fossil finds. It is much safer to use a neutral term, such as "dendrogram" (Mayr, Linsley, and Usinger, 1953:58), for a diagram of hypothetical descent based exclusively on the comparison of living forms. In view of the mounting evidence for frequent evolutionary reversal and convergences in adaptive characters, it is quite inadmissible to apply the term "phylogenetic tree" to a diagram that portrays merely morphological sequences.

This plea for caution should not be misunderstood by evolutionists. If one believes in evolution (and which biologist does not?), one is justified in proposing hypotheses concerning the probable relationships of families and

genera, and concerning the probable characteristics of their common ancestors. However, one should at no point confuse fact with hypothesis. This is for two reasons particularly important with respect to birds, the almost complete lack of crucial connecting links in the fossil material that is so far available, and the anatomical uniformity of birds, particularly the song birds. The case is not quite hopeless, since morphological assignments have often been confirmed by ethological findings (such as the relationship of sandgrouse to pigeons, and penguins to tubinares). Yet it is advisable to exercise great caution and to weigh carefully the phylogenetic versus functional significance of each character.

My final criticism is raised on grounds of logic. As pointed out previously by Tordoff (1954*b*), Beecher frequently indulges in circular reasoning. One example relating to the age and distribution of the "stem" groups has already been discussed. An additional example follows: Beecher states that seed-eating song birds and shrikes (super-family Timalioidea) have a pinnate *M7b*. Seemingly this functional adaptation is associated with the food habits of shrikes and finches. Beecher then concludes (1953:278) that his sylvioid assemblage with parallel *M7b* was unable to develop shrikes or finches and that the ability of the timalioid groups to do so constitutes a major point of distinction between the two superfamilies. The logic of this is vulnerable, to say the least, since the arrangement of the fibers of *M7b* is Beecher's fundamental criterion of distinction between the two groups. He has made certain that no members of the Sylvioidea has a pinnate *M7b* by placing all groups in which this muscle is pinnate in the Timalioidea! He cannot justifiably argue then that the Sylvioidea lack the ability to evolve a pinnate *M7b* since the distinction is an artifact.

* * *

As a consequence of having made the various assumptions listed above, Beecher proposes a phylogeny of song birds which is unsatisfactory in many respects. There are numerous indications that Beecher has placed unrelated forms together merely because they have become specialized or de-specialized in a similar manner. Some of the instances, such as bringing together the tanagers and the cardueline finches or placing the Indigo Bunting and its relatives in the Emberizinae, have been criticized previously by Tordoff (1954*b*). I would like to cite some other proposals of Beecher's which to me seem highly dubious: The derivation of the larks from the Cisticolinae; placing *Hemipus* with the monarch flycatchers and *Tephrodornis* with the Prionopinae; associating the parrot-bills with the larks, while making the unsupported claim (p. 314) that "The parrot-bills are basically similar to larks and pipits in . . . bill"; wide separation of *Remiz* (p. 319) from the flower-

peckers; inclusion of *Rhipidura* with the monarch flycatchers, and deriving *Pachycephala* and the vireos from the monarchs; the separation of *Aegithalos* (p. 315) and *Aegithaliscus* (p. 319); the placing of Carduelinae and Estrildinae at opposite ends of the system (fig. 18); and the establishment of certain phylogenetic series, such as that of Monarchinae — Cisticolinae — Troglodytidae — Certhiidae — Sittidae — Paridae.

Conclusions

It is evident from the above discussion that Beecher's attempt to establish a new phylogeny of the oscinine birds, based primarily on the morphology of the jaw muscles, is not an unqualified success. He has shown numerous variations in the jaw muscles, many of them previously unknown, thus making a distinct contribution to descriptive avian anatomy. Yet, it seems to me that his basic contention, namely that the stated anatomical differences support the postulated phylogenetic sequence, remains unproven. Indeed, the close correlation established by Beecher between pattern of jaw muscles and habits suggests strongly that the specific development of these muscles is functionally conditioned. This does not deprive these muscles of all phylogenetic significance, because closely related genera will have a larger number of similar potentialities than will distantly related genera. Yet this evidence must be used with much caution.

The papers of Tordoff and of Beecher have shown that the song birds are not nearly so uniform anatomically as was formerly believed and that the study of previously neglected structures may shed new light on function and relationship. It is to be hoped that the newly awakened interest in bird anatomy and bird phylogeny will result in many other stimulating contributions. Let the students in this field, however, be aware of the great logical difficulties of the subject and of the many intellectual booby traps into which the unwary may stumble.

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Literature Cited

Beecher, W. J.
1951*a* Adaptations for food-getting in the American blackbirds. *Auk*, 68:411–440.
1951*b* Convergence in the Coerebidae. *Wilson Bull.*, 63:274–287.
1953 A phylogeny of the oscines. *Auk*, 70:270–333.
Huxley, J.
1942 Evolution. The Modern Synthesis. London; Allen and Unwin, Ltd.

MAYR, E., E. G. LINSLEY, AND R. L. USINGER
1953 Methods and principles of systematic zoology. New York; McGraw-Hill Book Co.
SIMPSON, G. G.
1953 The major features of evolution. New York; Columbia Univ. Press.
SUSHKIN, P. P.
1925 The evening grosbeak (Hesperiphona), the only American genus of a Palaearctic group. *Auk*, 42:256–261.
TORDOFF, H. B.
1954*a* A systematic study of the avian family Fringillidae based on the structure of the skull. Misc. Publ. Mus. Zool. Univ. Mich., no. 81:1–42, 77 figs.
1954*b* Relationships in the New World nine-primaried oscines. *Auk*, 71:273–284.

MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS, NOVEMBER 17, 1954

OBSERVATIONS ON THE SUMMER TANAGER IN NORTHEASTERN KANSAS

BY HENRY S. FITCH AND VIRGINIA R. FITCH

THE Summer Tanager (*Piranga rubra*), a characteristic inhabitant of deciduous forests of the eastern United States, reaches its western limits in Kansas. The records for this state are concentrated near the eastern edge. Specimens in the University of Kansas Museum of Natural History were collected in Doniphan County (Geary, August 24), Wyandotte County (Bonner Springs, May 11), Douglas County (Lawrence, April, May, August and September), Miami County (Pigeon Lake, May 31), Labette County (10 mi. SW Oswego, July 6, 12 and 19), and Montgomery County (4 mi. N Caney, August 7 and 10). W. S. Long (unpublished thesis, Univ. Kansas Library, 1935) gives nesting records from Doniphan County and Kansas City. Nearly all these localities fall within the Deciduous Forest Formation as mapped by Braun (1950. "Deciduous Forests of Eastern North America"), and the others are closely adjacent to it.

On the University of Kansas Natural History Reservation, 5½ miles NNE Lawrence, this tanager is regularly present in summer as a breeding species. The earliest recorded dates for three different years were April 27, 1951, April 26, 1952, and April 28, 1953. These dates probably approximate the time of arrival and each year the tanagers were seen and heard frequently throughout the month of May.

Spatial Relations of Pairs

In May and June, 1952, singing males were recorded at seven well-separated locations on the 590-acre Reservation. In 1953 singing males were heard in six different locations, four of which corresponded well with the 1952 locations (see Fig. 1). Several pairs were seen repeatedly at about the same places. No encounters between members of different pairs ever were seen and the territories were so well spaced that, from the trees used as singing stations, songs of neighboring males never were audible. A minimum breeding population of at least six or seven pairs must have been present on the Reservation each year. Since some parts of the area were visited infrequently, and no systematic attempts at census were made, several additional pairs may have been present.

In every instance, pairs had their territories or headquarters in thick second-growth deciduous woods of elm (*Ulmus americana*), oaks (*Quercus Muehlenbergii, Q. velutina*) and hickory (mainly *Hicoria ovata*). However, the male of a pair that stayed near the Reservation buildings and another male seen and heard frequently did most of their singing in large honey locusts

(*Gleditsia triacanthos*) that were in fields near woodland edge. The woodland areas of more xeric aspect, notably south slopes dominated by such species as osage orange (*Maclura pomifera*), honey locust, and hackberry (*Celtis occidentalis*), were used little or not at all by the tanagers.

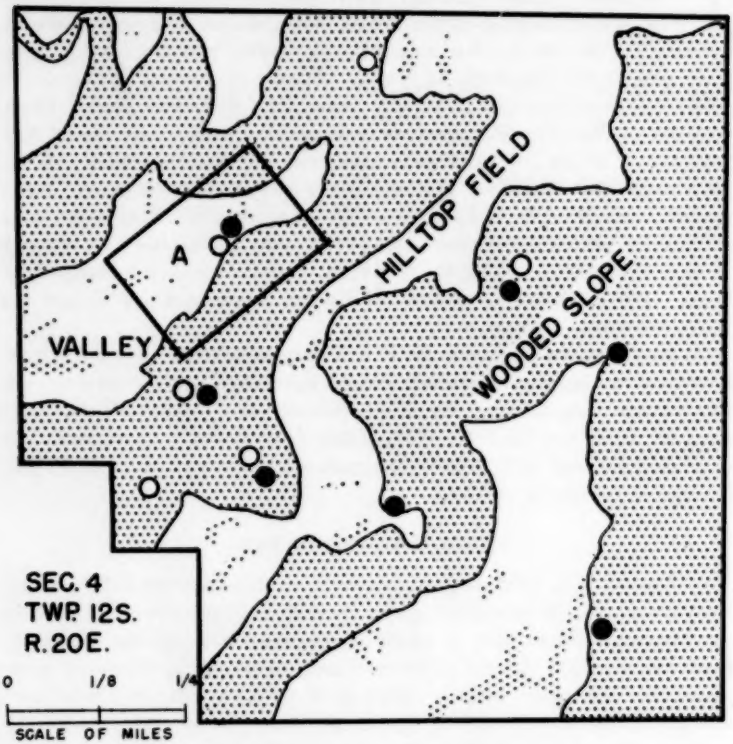

FIG. 1. Map of University of Kansas Natural History Reservation showing locations where pairs or singing males of summer tanagers were recorded in 1952 (solid circles), and in 1953 (open circles).

PRE-NESTING BEHAVIOR

Tanagers tended to stay in tree canopies, where they were inconspicuous and were usually unnoticed except when the distinctive clicking notes or song called attention to them. They were less wary than most other passerines in this locality, however, and often permitted approach to within 30 to 40 feet.

They sometimes exhibited curiosity, and flew nearer, with tail and crown feathers elevated, uttering clicking notes.

In early May, members of pairs were seen together on many occasions. The clicking notes seem to serve to keep each member of a pair informed of the other's whereabouts. In 1952 and 1953 a pair made its headquarters near the residence building at the Reservation, facilitating observations. History of this pair evidently was similar for the two years, but our records are

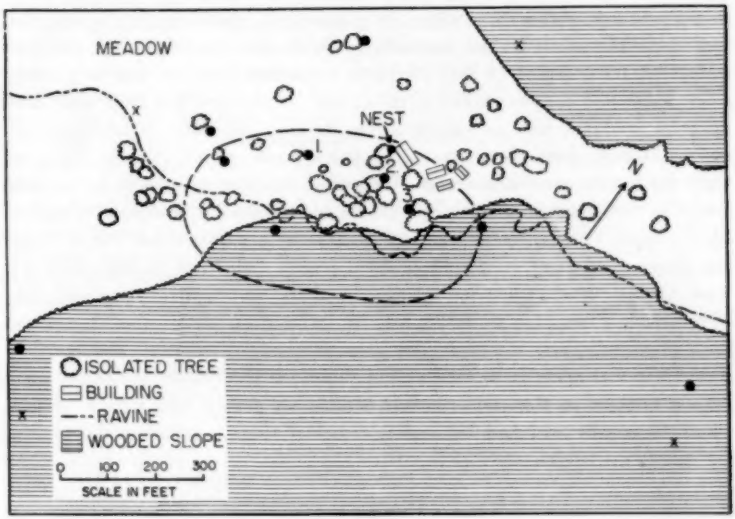

FIG. 2. Map of area shown in Fig. 1A, the area occupied by a nesting pair of summer tanagers in 1953. Dots show male's singing stations, with those most often used numbered in order of preference. Broken line encloses area within which the pair usually stayed. Outlying points occasionally visited by one or both members of the pair are shown by crosses, or by dots if singing male was recorded.

far more complete for 1953 (see Fig. 2). In that year singing was heard in the last three days of April and frequently in early May.

Throughout the season, frequent sudden and spirited pursuits of the female by the male were observed. The female, closely followed by the male, would fly rapidly and erratically, usually for a distance of several hundred feet. Often she was chased beyond the limits of the area to which that pair's activities usually were confined. Usually the course led into thick trees where the outcome could not be seen. Pursuits usually ended suddenly, the

birds resuming their routine activities. On some occasions the male followed the female slowly from tree to tree, both uttering clicking calls.

Nest Building

On the morning of May 11, the female was twice observed at a certain spot screened by thick foliage in the fork of an elm branch near one corner of the house. She was seen coming there again several times in the following week. On the afternoon of May 18, she was observed again, this time carrying stems to the nest site at this same place, in a horizontal crotch approximately 8½ feet above the ground. She was seen to fly to the ground nearby and find stems. On the morning of May 19, hasty inspection disclosed that as yet only a few stems had been deposited in the crotch. In the next few days additional material gradually was incorporated into the nest. On May 20, between 7:00 and 7:30 a.m., both members of the pairs made several trips to the nest. Only the female carried material. The male's function seemed to be to stand guard as she worked. Once when the female returned to the nest, a pair of Black-capped Chickadees (*Parus atricapillus*) were within a few feet of it and she drove them away by flying at them several times before depositing her load. Ordinarily she spent several minutes at the nest incorporating each load of material. From May 21 to 24, activity in building was greater than it had been previously, and the nest grew at a relatively rapid rate. Sometimes a round trip was made in as little as five minutes. The female ordinarily spent several minutes on the nest or beside it after her arrival with a load. At this stage she usually searched for nesting material along a ravine at the edge of the woods approximately 200 feet from the nest.

Incubation

On May 29 one egg was found in the nest, and on May 30 a second had been laid. On the morning of June 1, the clutch of four eggs was complete and the female had begun incubating. She permitted an observer to climb within four feet before she left. On June 5, at 9:00 a.m., the eggs were found to be uncovered. A few minutes later the female was heard nearby giving clicking notes and food calls, whereupon the male appeared and chased her several hundred feet south across the ravine and back again to the nest.

The eggs were observed daily during their incubation. On June 11 at 2:00 p.m. the female was sitting on the rim of the nest watching intently, while the male was perched a few feet away. Late in the afternoon we checked the eggs and found them all unhatched. On the following morning the male delivered food to the female as she sat on the nest. At 8:15 we checked the eggs and found that two had hatched. The third probably hatched later this same day, as it was found to have hatched on the following morning when

the nest was next examined. Thus the incubation period was approximately eleven days. The fourth egg did not hatch, and it still remained in the nest when the young were fledged.

The Nest

The nest was removed for study after the young were fledged. It was wedged in a 40° horizontal fork of the limb. Each branch was just under an inch in diameter. When removed from its support, the nest had a hole on one side which had been filled by the branch. The nest was 110 mm. outside and 75 mm. inside in greatest diameters, with minimum diameters of 83 mm. outside and 62 mm. inside. Depth was 35 mm. to the bottom of the bowl and 55 mm. to the bottom of the nest. The nest consisted of dried herbaceous vegetation of the previous year's crop and there were three main layers. The basal layer consisted chiefly of the panicles of white vervain (*Verbena urticifolia*). There were at least 41 of these, mostly 1 mm. to 1.5 mm. in greatest diameter and three to five inches long, each with several branches and with numerous minute protuberances where the inflorescences were based. These roughened and branched stems tended to adhere to each other and to the elm limb. Those deposited for the nest foundation were wedged into place adhering to the rough bark of the elm limb and providing a base for the support of additional material. A second layer, not entirely distinct from the basal layer and firmly woven into it, consisted of longer, more flexible stems of grasses, nearly all Japanese chess (*Bromus japonicus*), some with roots or empty seed heads, or both, still attached. These stems were mostly a little less than 1 mm. in diameter and up to two feet long, and 46 of them were counted. Material of the two outer layers was so tightly bound together that separate pieces were removed with difficulty and, as some breakage was unavoidable in the process of dismemberment, the exact number of units could not be determined. Binding material consisted chiefly of the shredded fibers of the stems themselves. Spider web had been included also, the tough, sticky strands of a large araneid, probably *Neoscona* sp. The web may have been gathered separately or may have been already attached to the stems. The inner layer lining the nest bowl was a mat of fine grass stems, mainly or entirely muhly grass (*Muhlenbergia Schreberi*) 0.5 mm. or less in diameter, and three to eight inches long. A total of 215 of these stems was counted. They were laid down in all directions and were woven and bound together much less tightly than the material of the outer layers. Material of the outer layer weighed 1.7 gm., that of the middle layer 1.8 gm., and that of the inner layer 2.7 gm.

Care of the Nestlings

Both parents participated in feeding the young. A partial record of their activities on June 15 is recorded below.

9:29 a.m.	Male delivered food to young.
9:30	Female delivered food and brooded briefly.
9:47	Male delivered food.
10:08	Female delivered food and brooded until 10:27.
10:30	Male delivered food and stayed at the nest for approximately one minute.
10:55	Both parents approached the nest and the male perched on a telephone wire fifty feet from it while the female delivered food and brooded.
4:06 p.m.	Female delivered food and sat on edge of the nest until 4:20.
4:57	Male delivered food and stayed at nest until 4:59.

5:05 Male delivered food and left.
5:15 Female delivered food and left.
5:20 Male returned briefly to feed young.
5:27 Female delivered food.
5:47 Female came to nest and brooded until 5:54.

On June 16, a Red-bellied Woodpecker (*Centurus carolinus*) was seen several times in the tree near the nest, and was driven away at least once by the male tanager.

Development of the Nestlings

At hatching the young were pink-skinned and well covered with buffy gray down. The edges of their bills were bright yellow. Their development was phenomenally rapid. Although attempts to measure these living young were not wholly satisfactory, the trend of growth is shown by the figures in Table 1. All measurements are to the nearest millimeter. For most of the samples,

Table 1

Growth in Young Summer Tanagers from Hatching to Fledging

Date	Number measured	Total length, mm.	Body length	Tarsus	Hind toe	Culmen	Gape	Weight, grams
June 12	1	—	24	8	5	7	9	4.2
June 13	1	42	—	8	6	7	13	5.2
June 14	2	52	30	11	7	6	14	8.7
June 15	2	56	34	13	9	8	13	11.4
June 16	—	—	—	—	—	—	—	—
June 17	2	74	44	19	11	10	14	17.3
June 18	2	79	45	19	11	10	14	17.1
June 19	3	87	46	19	12	11	13	17.3
June 20	2	93	48	19	13	11	14	17.8
June 21	—	—	—	—	—	—	—	—
June 22	1	96	50	18	13	11	14	18.2

only one or two of the three young were measured, as it was deemed inadvisable to remove all from the nest simultaneously. The young were not recognized individually for several days after hatching, and the records on consecutive days may have been based on different nestlings which differed somewhat in their development. Deviations from the general trend of growth are due in part to this factor.

On June 15, the three-day old nestlings had their eyes open but were sluggish and indifferent. Quills of the remiges had grown to 11.5 mm. Two days later these remiges had grown to 25 mm., and the feathers were beginning to

emerge from their sheaths in the most advanced nestling. The young clung tenaciously to the nest lining and were removed with difficulty on this date. On June 18, at an age of six days, one nestling squeaked in protest when removed from the nest. When placed on the top of a laboratory desk, it hopped about, chirping, its activity contrasting with the quiescence of all the nestlings on earlier dates. The slightly smaller nest mate was still quiescent, however. When both were returned to the nest, the active one raised itself onto the nest rim.

At 5:00 a.m. the following morning we were aroused by high-pitched, penetrating squeaks in the neighborhood of the nest and ran outside, thinking a predator was raiding it. The disturbance had ceased abruptly, but a Red-bellied Woodpecker was nearby in the tree. A few minutes later, looking through the window, we saw one of the nestlings hoist itself onto the nest rim. After a pause, it edged along unsteadily, out on the adjacent limb for several inches. It was maintaining a precarious balance with feeble fluttering, in what appeared to be an absurdly premature excursion. It made its way back along the branch but it continued without a pause past the nest. When it had progressed some inches farther, the nestling suddenly lost its balance and, fluttering frantically, gradually swung around to the lower side of the limb. There it hung upside down for a few seconds before it dropped to the ground, having the good fortune to fall in high brome grass where it was uninjured. Another nestling was found to have left the nest earlier the same morning, and it was located concealed in the grass a few feet away. The adults were making frequent trips with food which was delivered mainly to the single nestling remaining in the nest. However, within half an hour, this third nestling went through the same procedure already described, edging out onto a limb, then losing its balance and dropping into the grass.

To facilitate further observations, all three young were then gathered and placed in an open cardboard carton on the ground under the nest. The adults brought food regularly. The female was seen to make four trips between noon and 1:00 p.m. Once she left carrying a fecal pellet, but many other feces accumulated in the box, where the young were kept throughout the day.

Though still feeble and undeveloped for life in the open, the young had changed strikingly since the preceding day. The ends of the primary feather vanes were exposed to a length of 15 to 20 mm., and bodies were beginning to acquire a feather covering, especially on the breasts. The tail feathers had scarcely grown out at all.

On June 20, after being kept indoors overnight, the young were placed in the box beneath the nest soon after daybreak. At 6:00 a.m. shrill chirping similar to that heard on the preceding morning attracted our attention and,

hastening to the window, we saw a Fox Squirrel (*Sciurus niger*) approaching the box. Both parents were fluttering beside it and scolding. The squirrel, alarmed at our presence, fled to the shelter of the tree trunk and did not return. Through the day the female continued to feed the young confined in the carton, and several times she was seen to carry away fecal pellets. Late in the afternoon two young were missing from the carton. They were located by their chirping in the grass about five feet apart and both were returned. However, within a few minutes, one was seen to hop out a second time. It hopped and fluttered through the grass for about fifteen feet to the base of a large elm tree. Clinging to the rough bark, and vigorously fluttering its stubby wings, it walked up the vertical trunk for nearly four feet, then dropped back to the ground. It made several more similarly futile attempts to climb into the tree, while the female fluttered beside it, calling as if in encouragement. All the fledglings had made conspicuous gains in strength and vigor since the preceding day. By dusk only the most retarded one remained in the box, and again it was kept indoors overnight. At 4:45 a.m. it was put out beneath the nest. The female came and fed it at 5:00 a.m. At 5:30 she came again with food and, perching on the edge of the carton, she called to the young bird, causing it to flutter up beside her, thus escaping from its confinement. Several times during the day we retrieved it for further observation and confined it in other cages with higher sides open on top. Each time it escaped. Throughout the day young could be heard calling in the grass, chiefly within a 30-foot radius of the nest. They had become more wary and ceased to call whenever a person approached.

Behavior of Fledglings

On June 22 at 8:00 a.m. the female was seen to come to the trunk of the nest tree and feed one of the young which was perched on a twig five feet above the ground. When an observer approached, this fledgling "froze" in a bittern-like stance with bill pointing upward. When the observer came within reach, the fledgling flushed and flew 60 feet to a twig of another tree, maintaining its level. In attempting to alight, it lost balance and flew off in a new direction for 30 feet, then dropped into the grass. There it was found again frozen in the bittern-like stance observed previously. It did not flush from this low, concealed perch and it allowed itself to be grasped. Then it struggled and called with a high *sgwee ee rr* repeated several times. The sound caused the female to fly down scolding. For the several minutes that it was confined in a cage, the fledgling fluttered in vigorous attempts to escape and frequently uttered the two-syllabled hunger call *zhürri,* louder than it had called previously while in the open. Some of the exposed vanes of the primary feathers were as much as 28 mm. in length, and the rectrices had

grown to lengths up to 6 mm. The fledgling was now well feathered. The dorsal feathers were dark gray with yellowish edges, and the breast feathers were pale gray with dark streaks. Down was evident only on the head. The bill was mainly olive, with yellow at the tip and at the corners of the mouth.

Within the next two days the young shifted away from the vicinity of the nest tree to thick woods beside and beyond a ravine 200 feet farther south. They were not seen again at close range, but the family group was glimpsed in the tree tops from time to time. On July 10 and 11, for instance, a fledgling was seen to follow the female, giving food calls, while the male was nearby. As the tanagers were staying in the tree tops and were difficult to follow, or even to see, we were unable to determine how many fledglings remained but seemingly there were at least two.

Activities in Late Summer

The young were not definitely recorded after July 11, and may have dispersed from the parental territory at about this time. The adults were seen and heard frequently in their territory throughout July. The male's song was one of the most prominent of bird voices in late July and early August. His song began in morning twilight, often while Whip-poor-wills (*Caprimulgus vociferus*), Barred Owls (*Strix varia*), and Horned Owls (*Bubo virginianus*) were still calling, and he resumed singing from time to time throughout the day. On August 10 singing was heard frequently. On subsequent days song was no longer to be heard, although the clicking calls of tanagers were heard on August 14, 25, and 28.

Similarly in 1952, singing ceased abruptly in our absence between July 27 and August 11, although brief snatches of song were heard on August 21 and September 7. At least some of the tanagers remain in this area throughout most of September. There are specimens in the University of Kansas Museum of Natural History collected on the 14th, 15th, and 25th of that month. On September 27, 1953, a male was seen in a walnut tree near the house, giving the clicking call notes. Twice in the quarter hour that it was watched, it was seen to catch large black wasps (*Polistes fuscatus*) abundant in the vicinity. These were eaten after much pecking and battering.

Summary

There are many records of the Summer Tanager for Douglas County, Kansas, and scattered records for other parts of extreme eastern Kansas. Several pairs breed in the vicinity of the University of Kansas Natural History Reservation every year. Tanagers arrive approximately the last week of April.

In one pair observed in 1953, nest-building extended over a little more than

two weeks and was done entirely by the female. Incubation lasted eleven days. From a clutch of four eggs, three hatched and all the nestlings were fledged. At an age of one week all three young left the nest, one at a time, and fell to the ground. At this age, although nearing adult size, the young were still remarkably undeveloped, feeble, and nearly helpless, depending almost entirely on concealment in ground vegetation. After spending three days hiding in the grass near the nest site, the young became sufficiently strong and well feathered to fly into nearby trees. Soon they moved away from the nest site but remained in the parents' territory for nearly three weeks longer. Tanagers remain in the general area through August and September. Singing ceased abruptly after August 10. For the remainder of the season tanagers were usually silent and inconspicuous.

Natural History Reservation, University of Kansas, Lawrence, Kansas, February 1, 1954

A STUDY OF PURPLE FINCH WINTER WEIGHTS

BY FRED D. BARTLESON, JR. AND OVE F. JENSEN

THIS paper is a report on the data collected by Mrs. Jensen during the winter stay of Purple Finches (*Carpodacus purpureus*) at her banding station in Chapel Hill, North Carolina, from December 16, 1946, to April 12, 1947. During this time over 1300 weights of 494 individual Purple Finches were recorded. Each bird was banded and weighed when trapped, and time of trapping was recorded. It was thought that it might be interesting to compare the results of this study to the findings of Baldwin and Kendeigh (1938), who analyzed the weights of a large number of birds of various species, but recorded only 11 weights of the Purple Finch.

The authors wish to express their appreciation to Drs. Howard T. Odum and Pierce Brodkorb, of the University of Florida, for advice in the methods of collecting data and suggestions in the preparation of this paper.

SEX AND AGE DIFFERENCES

The data on weights were analyzed to make comparisons between males and females and between adults and immature birds. All weights were valued equally whether or not more than one weight came from a single individual, regardless of temperature and other factors. Since the plumage of adult females is indistinguishable from the first winter plumage (Dwight, 1900), it was not surprising to find that nearly two-thirds of the banded birds were brown females and immature males. Pink males made up only one third of the sample. The weights of the females and immatures were plotted against their frequencies on a graph. This was "fitted" to a normal curve (formula from Simpson and Roe, 1939) and tested by chi-square in order to determine whether or not the populations were homogeneous. The curve obtained was normal and bell shaped, with no indication of bimodality. The calculated "P" value or probability that the actual data differed from the bell shaped curve was about 0.60, which strongly suggests that the weights of the immature and adult female Purple Finches are, for all practical purposes, the same.

The weights of the males then were analyzed and were found to have no significant differences in mean, standard deviation and variation from the weights of females and immatures (Table 1). Since no differences in the weights of any of these three groups could be found, the groups will be considered as one in the remainder of this study. Although the weights of these groups of birds were apparently the same during the period studied, it is quite possible that the males and females differ significantly during the breed-

TABLE 1

WINTER WEIGHTS OF PURPLE FINCHES (IN GRAMS)

Sex	No.	Extreme	Mean	σ	"t"	P.	V.
Females and First-year Males	906	21.0–32.0	26.06	1.752	.1045	.92	.067
Adult Males	394	19.5–31.0	26.01	1.687			.065

σ—standard deviation of means. "t"—calculated significance of differences of means. P.—probability. V.—coefficient of variation. (Formulae from Simpson and Roe, 1939)

ing season, and the immatures most certainly differ from the adults for at least the first few months after hatching.

HOURLY VARIATION

As an expected result of utilization of food and defecation at night, the early morning weights of these finches were comparatively low. The rate of increase in weights was rapid for the first few morning hours and then slowed down until about noon (Fig. 1). This phenomenon was also noted in Goldfinches (*Spinus tristis*) by Stewart (1937). Another increase in Purple Finch weights was noted in the early afternoon hours. By a little after 3:00 p.m. the Purple Finches had reached their maximum mean weight of 26.8 grams. This is a gain of 3.5 grams from the average for 6:00 a.m. or an increase of 13.5 per cent of the average daily weight. Nice (1937) found that the highest weights in Song Sparrows (*Melospiza melodia*) were reached somewhat later in the afternoon. After 3:00 p.m., there was a sudden drop in the mean, amounting to 1.4 grams within the next two hours. The remaining 2.1 grams were lost sometime during the night. Even though the lowest weight may be reached before 6:00 a.m., the rate of weight loss certainly must be rapid.

The main difference between our results and those of Baldwin and Kendeigh (1938:429) is that, whereas they found the maximum weight in the late afternoon or early evening, we found it occurring in mid-afternoon. The differences here may possibly be attributed to the relatively shorter length of day during the winter, or to the fact that the great majority of Purple Finches were observed to stop feeding in the middle of the afternoon and to leave the station area sooner than other species.

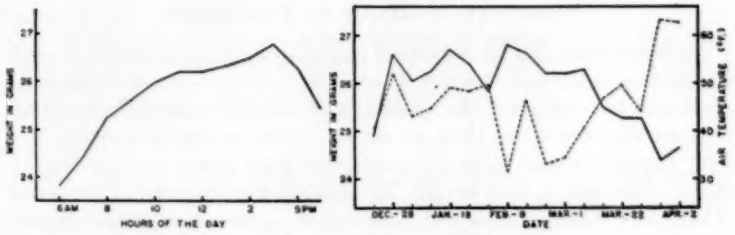

FIG. 1.—Hourly variations in mean weight of Purple Finches.

FIG. 2—Weekly variations in air temperature (Fahrenheit) and body weight of Purple Finches. Broken line indicates temperature. Unbroken line indicates weight.

WEEKLY VARIATION

In examining the variations of weight during weekly periods, it was seen that there tends to be an increase in weight from the last of December to early February. After this time, the birds became progressively lighter until they left the area sometime in the first two weeks of April. There are two weeks which do not fit this trend. The first was the last week in December, in which the body weight was nearly a gram higher than would be expected. There were only ten records for this period, which might account for the discrepancy. The second period which did not show the expected result was the first week in February. During this period, when it probably should have been the highest, the weight was about a gram lower than expected. The cause of error here was probably not due to the number of weights (73) recorded. In this particular week the daily temperatures were relatively high in comparison to those recorded during the rest of the period of the study, often reaching 75° F. This would tend to support the view held by Baldwin and Kendeigh (*op. cit.*:449) that at high temperatures the body weight of birds decreases.

From the work of Wolfson (1945) on Oregon Juncos (*Junco oreganus*) and Odum (1949) and Odum and Perkinson (1951) on White-throated Sparrows (*Zonotrichia albicollis*), one would think that the Purple Finches would have tended to gain weight, due to fat deposition, in preparation for their spring migration. This does not appear to have been the case in the Purple Finches studied. The lowest average weights were recorded during the last two weeks preceding migration. However, it is quite possible that the birds left the station just before migration and put on weight elsewhere, or added the weight very suddenly.

Correlation of Weight and Temperature

The temperature data for the Chapel Hill area, which were received through the courtesy of the United States Weather Bureau, were plotted on the same graph with body weights. The results appear quite confusing (Fig. 2). Data from the first few weeks show an almost perfect positive correlation. For every increase or decrease in air temperature there was a corresponding increase or decrease in body weight. The data for the remainder of the period of this study, however, show both positive and negative correlations intermittently.

In order to see if there were any association between the temperatures and weights observed, a contingency table was devised and tested by chi-square. The resultant X^2 value obtained was 588.1, with four degrees of freedom. The differences between the observed and expected frequencies, therefore, could not have arisen by chance. Thus, it follows that there is significant association between the weights and temperatures.

A coefficient of correlation ("r") test was used then to determine just what this association was. An "r" value of plus or minus 1.0 indicates complete positive or negative correlation, as the case may be, whereas an "r" value of zero indicates that there is absolutely no correlation. The "r" value found in this case was –.543. To answer the question, "could this deviation of 'r' from zero have arisen from chance?", a significance of difference test was used. The "t" value of 22.8 obtained necessitates the conclusion that the difference between the coefficient of correlation value obtained and zero is significant. Thus, there is an inverse, or negative, correlation between body weight in Purple Finches and air temperature.

Summary

(1) The winter weights of 1300 Purple Finches at Chapel Hill, North Carolina, were compared with previous work on weight variation in passerines. (2) Over the period of study, no significant differences in weight among adult males, adult females, and immature birds were found. (3) The highest hourly weight occurred shortly after 3:00 p.m. (4) Average weekly variation in weight showed an increase from the last of December to the first week in February, and then a gradual decrease until the finches left the area in their spring migration. (5) An inverse, or negative, correlation was found between air temperature and body weight.

Literature Cited

Baldwin, S. P. and S. C. Kendeigh
1938 Variations in the weight of birds. *Auk*, 55:416–467.

DWIGHT, J., JR.
1900 The sequence of plumages and moults of the passerine birds of New York. *Ann. N.Y. Acad. Sci.*, 13:73–360.

NICE, M. M.
1937 Studies in the life history of the song sparrow. *Trans. Linn. Soc. New York*, 4: vi + 1–247.

ODUM, E. P.
1949 Weight variations in wintering white-throated sparrows in relation to temperature and migration. *Wilson Bull.*, 61:3–14.

ODUM, E. P. AND J. D. PERKINSON, JR.
1951 Relation of lipid metabolism to migration in birds: Seasonal variation in body lipids of the migratory white-throated sparrow. *Physiol. Zool.* 24:216–230.

SIMPSON, G. G. AND A. ROE
1939 Quantitative zoology. New York; McGraw-Hill Book Company.

STEWART, P. A.
1937 A preliminary list of bird weights. *Auk*, 54:324–332.

WOLFSON, A.
1945 The role of the pituitary, fat deposition, and body weight in bird migration. *Condor*, 47:95–127.

DEPARTMENT OF BIOLOGY, UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA, AND MAPLE CITY, MICHIGAN, APRIL 26, 1954

GENERAL NOTES

Records of Swainson's Warbler in southern Illinois.— Swainson's Warbler (*Limnothylpis swainsonii*) is typically associated with extensive southern bottomlands and shallow swamplands, particularly where there are large cane brakes, *Arundinaria gigantea* (Walt.) Chapm. Although southern Illinois is at the northern limit of such habitat, there are a few places along the rivers and creeks that harbor fairly good growths of cane. In these areas Swainson's Warbler has been recorded occasionally, although the records are extremely few and irregular. The few published observations are as follows: Wabash County in April (Ridgway, 1878. *Bull. Nutt. Orn. Club*, 4:163); Perry County in June (Gross, 1908. *Auk*, 25:225); Alexander County in May and Johnson County in June (Howell, 1910. *Auk*, 27:216); near Cairo, Alexander County, in September (Ammann, 1939. *Wilson Bull.*, 51:185). These were the only published records of the warbler for southern Illinois until mention of some of the following observations appeared in *Audubon Field Notes* (1951. 5:292; 1952. 6:292). No published observations of Swainson's Warbler were made in southern Illinois over an extended period in summer prior to 1951.

On April 29, 1951, Richard Brewer and I discovered a singing male Swainson's Warbler in the extensive Cave Valley cane brake, two miles north of Pomona in Jackson County. With further searching during the following weeks, we found the male singing on May 15 and June 16, but otherwise were unable to discover any clue to its status. On July 1 we observed a Swainson's Warbler at close range in an upland forest adjacent to the swamp. The bird was excited by our presence, as if perhaps concerned for the safety of a nest or young birds. It carried insects in its bill and fluttered on the ground almost to our feet, but, although we searched carefully, we were unable to discover a nest. No further observations were made of the species in 1951. Observations of Swainson's Warbler in 1952 were made on May 4 and 20, and on July 4; all were of a singing bird or birds, obviously not excited by the observer's presence. Other duties prevented our searching for the possible nest during the remainder of 1952. In 1953, drought conditions caused the swamp to go nearly dry, so that repeated search for Swainson's Warbler yielded only one late May observation and no summer records. In 1954, moisture conditions returned to near normal, and with this condition Swainson's Warbler again appeared in the Cave Valley swamp in summer. Brewer and I heard a singing male on June 13, and I observed an individual on June 19. We both watched a singing male on July 3 as it fed or gathered food on the ground in the swamp. The preceding observations definitely establish Swainson's Warbler as a summer resident in Illinois. Furthermore, the actions of the bird or birds observed in suitable breeding habitat would seem to indicate nesting activities. It is hoped that these records will assist in ultimately clarifying the status of Swainson's Warbler in Illinois.—JOHN WILLIAM HARDY, *Department of Zoology, Southern Illinois University, Carbondale, Illinois, August 2, 1954.*

Tail winds and migration.— The *Wilson Bulletin*, vol. 66, no. 2, June, 1954, contains several articles dealing with the relationship of weather, particularly of wind direction, to bird migration; and there have been a number of other recent articles on this general subject in several journals. There seems to be general agreement among most authors that birds tend to drift with the wind, something like aerial plankton, but there seems also to be a general tendency to assume that the wind blows from the same direction at all levels. This is by no means the case; and a couple of observations on the Preston Laboratories' grounds in Western Pennsylvania seem to show that birds of many species can find and use a limited stratum of air that is moving in the direction in

which they want to go, even though at other levels there may be strong crosswinds or even headwinds. How the birds discover these critical levels is not obvious. It may be that they observe the drift of insects or clouds or true aerial plankton, or possibly they find the levels in some cases by accident or by observing other birds which have discovered the right level.

On September 27, 1953, at 10:15 a.m. I looked up and saw, at a height above ground of about 2,000 feet, an Osprey (*Pandion haliaetus*) headed south with the speed of an express train and without the slightest motion of its wings. At this I was very much surprised, because at the ground level the wind around my face was blowing strongly from the south, while at really high levels (say 10,000 feet), the few wispy clouds were scurrying east on a strong west wind. The bird had scarcely passed when I saw three Purple Martins (*Progne subis*) hawking where the Osprey had been and apparently migrating south too. A few moments later some wisps of cloud appeared at the same altitude, and, although they dissipated almost at once, they lasted long enough to show that at this level the wind was in fact blowing strongly from the north. The birds had discovered this condition and were making use of it. In the course of the next hour, the clouds thickened a great deal, and it was evident that at levels no higher than 5,000 feet above ground the wind was from the west. Thus the north wind was confined to a rather shallow stratum, and below this the wind would have opposed the birds, or at least would not have assisted them. The increasing cloudiness indicated that some change in the weather, and in the atmospheric circulation, was brewing and that the favorable stratum was not merely shallow in space but most likely fleeting in time.

On May 24, 1954, the early wind was from the north, but later in the day a dead calm prevailed. Around 3:00 a.m., May 25, a thunderstorm passed through, presumably a line-squall on a "front," and at 7:45 a.m., the ground wind was from the south, although at cloud level, several thousand feet up, the wind was from the west and was strong.

A mass migration of warblers and other birds rode the south wind and our woods were full of them, but by 8:15 a.m. the warblers had passed through, leaving behind numbers of Red-eyed Vireos (*Vireo olivaceus*) and Wood Pewees (*Contopus virens*) (the first of the season in each case). Several other species of summer residents seemed to increase in numbers suddenly at the same time. At 9:15 a.m. the ground wind was no longer from the south, but from the west, and was strong. The migration was confined to the south wind, and this wind was confined in space to a shallow stratum near the ground, and in time (at the laboratory) to a few hours, certainly not extending longer than from about 3:00 a.m. (time of the thunderstorm) to 8:00 or 9:00 a.m., and perhaps much less.

The following comments, from a private letter from Mr. Henry Rockwood, Meteorologist-in-Charge, U.S. Weather Bureau, Pittsburgh, have been condensed slightly without changing their sense.

"Wind direction is chiefly a function of the pressure patterns in the atmosphere, which at the surface (neighborhood of ground level) tend to be rather complex. As we go aloft, the pressure patterns tend to become increasingly simpler. This means that wind direction is not the same throughout the atmosphere, but varies with altitude. One of the simpler variations is a clockwise shift with height, which indicates the advection of a warmer airmass into the area. At other times the shift is counterclockwise with height, which means the advection of a cooler air mass.

"Because of the complexity of pressure patterns mentioned above, it is possible for a rather strong low pressure center moving eastward across the Great Lakes to induce a

surface flow at Pittsburgh from south to southwest. At intermediate levels though, the low center may be slightly farther west and more V shaped so that winds will be more northerly or northwesterly. At much higher levels low pressure may not be apparent at all and winds at those levels could well be from the west.

"The duration of a particular pattern is chiefly a matter of a rate of movement of the pressure systems and may last for a few hours at the least to a day or more. It might well be that migrating birds, consciously or unconsciously, seek out the optimum level for their direction of flight."

Although only two occasions are reported above when a particularly striking set of circumstances was obvious, it seems likely that many more would be observed if they were carefully watched for.—F. W. Preston, *Preston Laboratories, Butler, Pennsylvania, August 13, 1954.*

An avifauna from the Pleistocene of central Kansas.—The avifauna described here is the result of ten years of intermittent collecting of vertebrate remains from a Pleistocene deposit in the NE¼ sec. 14, T.18S., R.3 W. (Kentuck locality of Hibbard, 1952. *Univ. Kansas Paleont. Contr., Vert., Art.* 2:6), McPherson County, Kansas, by members of the Kansas Geological Survey, Museum of Natural History, and Department of Anatomy, University of Kansas. I wish to acknowledge the critical advice of Dr. H. B. Tordoff, University of Kansas, and the use of comparative material in the University of Kansas Museum of Natural History and the National Museum, Washington.

The specimens, all in the University of Kansas Museum of Natural History, represent the following species:

Family Anatidae

Anas carolinensis Gmelin, Green-winged Teal. Nos. 9908 and 9909, distal ends of right humerus.

Lophodytes cucullatus (Linnaeus), Hooded Merganser. No. 9910, proximal end of left carpometacarpus. No. 9911, shaft and distal end of left carpometacarpus.

Family Scolopacidae

Bartramia longicauda (Bechstein), Upland Plover. No. 9912, left coracoid.

Numenius borealis (Forster), Eskimo Curlew. No. 7428, humeral end of right coracoid.

Family Icteridae

Euphagus cyanocephalus (Wagler), Brewer Blackbird. No. 7354, humeral end of left coracoid. This specimen and no. 7428, listed above, were reported (as unidentified birds) by Hibbard (*loc. cit.*).

To my knowledge, this is the first record of *Numenius borealis* as a fossil. The remaining four species are known from late Pleistocene deposits, to wit: *Anas carolinensis*, Florida (Wetmore, 1931. *Smithsonian Misc. Coll.*, 85:21), Oregon (Howard, 1946. *Carnegie Inst. Wash. Publ.*, 551:191), California (Howard, 1949. *Condor*, 51:21 — a tentative identification), and Nevada (Howard, 1952. *Bull. So. Calif. Acad. Sci.*, 51:54); *Lophodytes cucullatus*, Florida (Wetmore, 1931. *op. cit.*:23) and Oklahoma (Lunk, 1952. *Condor*, 54:317); *Bartramia longicauda*, Kansas (Downs, 1954. *Condor*, 56:211); and *Euphagus cyanocephalus*, Oregon (Howard, 1946. *op. cit.*:192). Fragments, closely resembling parts of *Anas carolinensis*, have been reported from the lower Pliocene of Texas (Compton, 1934. *Condor*, 36:41) and lower Pliocene of Nevada (Miller, in Merriam, 1916. *Univ. Calif. Publ., Bull. Dept. Geol. Sci.*, 9:173). Judging by the result of Wetmore's (1944. *Univ. Kansas Sci. Bull.*, 30:92–94) study of *Anas bunkeri* from the Blancan of Kansas, it

is probable that these specimens from the Pliocene of Texas and Nevada would prove to be different from the existing species if more material were available for study.

The age of this avifauna is probably late middle Pleistocene or early upper Pleistocene. Hibbard (1952. *op. cit.*:11) regarded the stream deposit from which the Kentuck assemblage was collected to be younger than beds containing the Borchers faunule of Meade County, Kansas. Some of the mammals in the assemblage suggest an age roughly near that of the Cragin Quarry faunule and other fossils from the Kingsdown, or lower Sanborn, formation. The bird bones listed here provide no evidence of having been associated with the fossils of pre-Borchers age that Hibbard thinks were redeposited with the younger post-Borchers fossils to make the Kentuck assemblage. In any event, without better faunules for correlation it is enough to say that the deposits containing this avifauna are probably late Yarmouthian or Illinoian in age.

This collection is of interest because there is nothing in it to show that there have been any great and profound changes in the avifauna of the High Plains since the end of the middle Pleistocene. The five species have been inhabitants or migrants in the High Plains within historic times. The similarity of all seven of the fragments to the corresponding parts of Recent species increases the probability, in my opinion, that the species had attained, or were near, their present form by mid-Pleistocene time. With a collection as small as this one such a view would not exclude the presence of now extinct species or the possibility that slight morphological differences existed.—Edwin C. Galbreath, *Department of Anatomy, University of Kansas, Lawrence, Kansas, August 6, 1954.*

An early seasonal record of the Swallow-tailed Kite in Florida.— A Swallow-tailed Kite (*Elanoides forficatus*) was seen by the writer on February 6, 1954, flying over Payne's Prairie four miles south of Gainesville, Alachua County, Florida. The bird was sighted about 8:00 a.m. and was watched through 7 × 50 glasses for about 40 minutes as it circled overhead. The bird then flew southeast. According to the weather station at the University of Florida, at Gainesville, the temperature was 47° F. at 8:30 a.m. The weather was clear following a heavy frost and there was a slight wind from the northwest.

The species is a rare summer resident in this area, and as far as can be ascertained, this is the earliest record of its occurrence in Florida. Howell (1932. "Florida Bird Life," p. 164) gives the earliest record as February 28, 1920, at St. Marks, or the "last week in February, 1876" at Panasoffkee Lake.—Thomas W. Hicks, *University of Florida, Gainesville, Florida, August 10, 1954.*

Red Phalarope in Ohio.—On May 1, 1953, while flying through a rapidly moving storm system near Columbus, Ohio, our crew noticed clouds of dust blowing along at 8,000 feet above sea level. Later we learned that the system had caused dust storms in the Great Plains and tornadoes in Macon, Georgia, and other places as it moved eastward.

An hour before sunset on the next day, I found a Red Phalarope (*Phalaropus fulicarius*) swimming on a small pond in the Game Preserve in Area C, Wright-Patterson Air Force Base, Dayton, Ohio. The bird was busily snapping up black "flies" which were numerous within three inches of the surface of the water. The bird must have been starving, for it paid little attention to my family and nearby fishermen as it darted after the insects. It came within 25 feet of me as I watched with 8 × 30 binoculars. The yellow, dark-tipped

bill was diagnostic. The bird was apparently a female midway between winter and spring plumage. It had a gray back, almost black crown and nape, and cinnamon-red mottling on the breast.

The bird was rediscovered in a different part of the pond the next day by Lt. George DeCoursey, and it was seen by Dr. Richard Reinhardt, Mr. Carl Horst, and Mr. Bert Smith, now president of the Dayton Audubon Society. The phalarope stayed on the pond for five days. On the afternoon of May 6 the bird was photographed in fair light with still and movie cameras. Two hundred feet of black and white 35 mm. movie film and several good stills in color were taken with telephoto lenses. At this time the plumage seemed richer and the bird less tame. Occasionally, as it was swimming and spinning after black "flies," it would leap after them and flutter several feet across the water. This was our last observation.

Correspondence with Dr. Donald J. Borror of Ohio State University reveals that there is apparently no previous spring record for the state of Ohio and that none of the fall records for central Ohio has been from the Dayton area.—GERALD T. ROGERS, *Wright-Patterson Air Force Base, Ohio, August 26, 1954.*

Blue Jay anting with hot chocolate and soap suds.—A hand-raised Blue Jay (*Cyanocitta cristata*) obtained June 17, 1950, at the estimated age of two weeks and kept until March 23, 1951, anted upon her first encounter with ants. (We assumed her sex because of the very small wing measurement—82.5 mm.) On September 17 she picked up a small ant and at once wiped it on her primaries, at the same time twisting her tail to one side. Later there was a suggestion of anting with some other small insects. On October 22 I gave her four small ants. She immediately anted with each one, rubbing them on both primaries and rectrices, in the mean time nearly falling from her perch. This was the last of her experiences with ants while with us.

On January 6 she helped herself to my daughter's hot chocolate. After each sip she spread out her wings and wiped her primaries from one to three times, doing this 14 times in succession. During the next two days I tried her on tea and coffee (both unsweetened), and again on hot chocolate. She took a few sips of each, but failed to ant.

On January 26 she was in the sink after the dishes had been washed, pecking around and sipping up drops of water. Twice she held out her wings and wiped under them.

A month later she watched my daughter making herself a cup of hot chocolate; she approached and helped herself, anting after each of 27 sips, wiping her bill on her primaries two or three times after each sip, usually on each wing alternately. She twisted her tail to one side, but did not ant on it. Finally she took two good drinks, anting after the second.

On March 13 she was perched on the edge of the dishpan that was half full of soapy, warm water. She took a sip and at once anted, doing this five times in succession. She then hopped into the water, but came out immediately, as it was rather too deep for a bath.

Many substitute objects have been reported as stimulating anting, but to my knowledge hot chocolate and dish water are new to the list. It seems evident that there is something in the taste of ants and various other substances that releases this curious behavior.—MARGARET M. NICE, *5725 Harper Avenue, Chicago 37, Illinois, September 2, 1954.*

Cabot's Sandwich Tern in New Jersey.—Although Cabot's Tern (*Thalasseus sandvicensis*) has been taken in New Jersey (Stone, 1937. Bird Studies at Old Cape May, 2:590), records of its occurrence so far north are, curiously, even fewer than for the much more southerly-distributed Sooty Tern (*Sterna fuscata*). Hence the following observation seems worthy of record.

Scrutiny of a resting flock of Laridae at Beach Haven Inlet, New Jersey, on September 1, 1954, revealed the long, rather slender, jet-black, distinctly yellow-tipped bill of a Cabot's Tern. First recognized at some distance through 12 × 50 binoculars, it permitted approach to within 25 feet. At that distance, in perfect light, its other characteristics, familiar to me from many previous meetings much farther south, could be readily checked. Apparently an adult in post-nuptial plumage, its forehead was white, its black nape noticeably crested, and its legs and feet black. Its size was slightly larger and its underparts were somewhat whiter than those of adjacent Common Terns (*Sterna hirundo*). Keeping an eye on the rarity, I beckoned to two nearby bird-students, Charles Atherton and William Evans, both of whom obtained very satisfactory views of the tern before we watched it fly toward the south, whence it had presumably been blown, a day or two before by Hurricane "Carol."

Three Royal Terns (*Thalasseus maximus*) carefully identified that day at the same locality may have been storm-blown also.—Frederick W. Loetscher, Jr., *Department of Biology, Centre College, Danville, Kentucky, September 17, 1954.*

Yellow-throated Warbler breeding along the Delaware River, Hunterdon County, New Jersey.—During mid-June, 1954, Mr. Vincent Abraitys of Sergentsville, New Jersey, located a singing Yellow-throated Warbler (*Dendroica dominica*) on an island in the Delaware River at Raven Rock. For two weeks following he made frequent trips to the area, finding the singing bird each time. It appeared to be keeping within a limited territory, which suggested to Abraitys the possibility of a nest.

On June 27, accompanied by Mr. Abraitys and Mr. Henry Barlow, I visited the island for the purpose of making a thorough search. We located the singing male without difficulty. It sang briefly from the top of a tall sycamore and then flew to another stand of sycamores near the center of the island. There we found a second bird.

Both of the warblers were very active, foraging among the leaves on the terminal branches of the sycamores and occasionally pursuing a flying insect. After obtaining a beakful, each would fly to an adjacent tree and disappear into the foliage of a grapevine. Although we searched carefully, neither the 10X binoculars nor the greater power of a 20X scope availed us to discover either nest or young in that impenetrable greenery.

We kept the feeding birds under observation and, within a few minutes, we noticed that they were no longer going to the grapevine but to a large sycamore some distance away. A careful study of that tree disclosed two young birds perched on a horizontal limb about fifty feet above the ground. While we watched, they were visited and fed by the parents.

The young warblers were fully fledged and appeared quite able to take care of themselves. Between parental visits they were active and their rapid movements and the thickness of the foliage of the trees made it difficult to observe them for more than a moment at a time. We could discern no differences in plumage between the adults and young other than the absence of the yellow throat on the latter.

Bent (1953. *U.S. Nat. Mus. Bull.* 203:358) does not include New Jersey within the breeding range of the Yellow-throated Warbler. So far as I know this species has not heretofore been reported breeding in this state.—Howard Drinkwater, *Old Road, Whitehouse, New Jersey, July 5, 1954.*

Juvenile Cowbird attended by Parula Warblers.—In Bent (1953. *U. S. Nat. Mus. Bull.* 203:145) it is indicated that, although instances are known, the Parula Warbler (*Parula americana*) is very seldom parasitized by the Cowbird (*Molothrus ater*). In view of this, the following observations may be of interest.

At about eleven o'clock in the morning of June 30, 1954, I was investigating the edge of a wet deciduous woodland near College Park, Maryland, when I discovered a fully-fledged young Cowbird being attended by a pair of Parula Warblers. Observation was continued for about ten minutes with 7 × 35 binoculars from distances of twenty to thirty feet. The Cowbird was on the ground at first, but it became somewhat alarmed at my approach, and flew unsteadily into the small trees at the forest edge. It uttered begging calls continually and solicited food from the warblers, as well as from an American Robin (*Turdus migratorius*) which seemed interested but did not feed the Cowbird. I clearly saw only the female warbler actually feed the latter, but the male remained near, apparently somewhat disturbed both by me and by the robin. He may have fed the Cowbird, but several of the acts of feeding were accomplished so quickly that I could not be sure which warbler performed them.

A short time later I saw a group of four adult Cowbirds (two males, two females) feeding on the ground about one hundred yards away.—Frank G. Anderson, *4608 Fordham Road, College Park, Maryland, July 6, 1954.*

Aquatic snails found attached to feathers of White-faced Glossy Ibis.—Several aquatic gastropods were discovered adhering to the feathers of a White-faced Glossy Ibis (*Plegadis mexicana*), by Edwin B. Davidoff while he was brushing the specimen for ectoparasites. The bird was collected two miles south of Orr's Ranch, Skull Valley, Tooele County, Utah, on May 25, 1954, by Mr. John Bushman. All of the snails were immature, making identification possible to genus only. Represented were *Physa, Lymnaea* and *Helisoma*, genera belonging to three distinct families of basommatophorous Pulmonata.

The importance of such observations lies in the valuable data they may furnish relative to possible avian dispersal of various mollusks. For example, Baker (1945. The Molluscan Family Planorbidae, Univ. Ill. Press, pp. 39–40) has pointed out the close similarity of migration routes and the distribution of some planorboid snails in the West Indian region, concluding that ". . . the populating of many if not all of the islands of the West Indies with planorboid and other fresh-water mollusks has been brought about through the agency of migrating birds." Some such similar mode of dispersal must be in operation to account for the distribution of aquatic mollusks in the widely separated bodies of water in the Bonneville Basin desert region.

It has long been known that various mollusks may become attached accidentally to the bodies of various other organisms, several excellent examples from the earlier literature having been cited by Kew (1893. "The Dispersal of Shells," Kegan Paul, Trench, Trubner & Co., Ltd.). Subsequent observations, several of which relate to attachment to birds, have appeared from time to time (citations in writer's file available upon request). I would like to reiterate here Baker's plea to ornithologists, sportsmen and others who have occasion to examine the bodies of birds to save any mollusks they may find and to turn these specimens over to a malacologist for study.—Ernest J. Roscoe, *Zoology Department, University of Utah, Salt Lake City, Utah, September 14, 1954.*

1955 ANNUAL MEETING

Members are reminded that the Thirty-sixth Annual Meeting of the Wilson Ornithological Club will be held at Stillwater, Oklahoma, April 7–10.

LOUIS AGASSIZ FUERTES RESEARCH GRANT

The deadline for applications for this grant has been extended to April 20, 1955. Application forms for this award of $100, established to promote ornithological research, may be obtained from Dr. Kenneth C. Parkes, Carnegie Museum, Pittsburgh 13, Pennsylvania.

ORNITHOLOGICAL NEWS

Some years ago Arthur Cleveland Bent, who died on December 30, 1954, arranged with James Lee Peters, at that time President of the Nuttall Ornithological Club, to have that organization agree to sponsor preparation of the remaining Life Histories of North American Birds should such action prove necessary. More recently, Mr. Bent had the Nuttall Club appoint Wendell Taber as Chairman with a free hand to choose his own committee. In May, 1954, Mr. Bent turned his work over to the Committee. Members are: Mrs. A. C. Bent, Alfred O. Gross, William G. F. Harris, Frederick C. Lincoln, Robert A. Norris, Christopher M. Packard, Lawrence H. Walkinshaw and Wendell Taber, Chairman. Contributions of material and photographs will be welcomed as before and may be sent to the most convenient member of the Committee.

It is hoped the volume on the Icteridae will go to the printer in the spring of 1955.

Of interest to bird banders is the appearance of a new publication, *The Ring*. The objective of this private publication is the international exchange of information on bird-ringing systems and other items of interest to workers in this field. The price of the first number is three shillings. The editor of *The Ring*, Dr. W. Rydzewski, 1 Altyre Rd., Croydon, Surrey, England, invites correspondence from bird banders in this country.

The 100-page gazetteer which appeared in part of 4 of James P. Chapin's "Birds of the Belgian Congo" is available as a separate with protective cover, priced at $1.00. Orders may be placed with the Department of Birds, American Museum of Natural History, New York 24, N.Y.

The Aves section of the *Zoological Record* covering ornithological literature for 1953 was issued in November, 1954. Ornithologists owe a debt of gratitude to Lt. Col. W. P. C. Tenison for his careful preparation of this valuable research reference. A standing order for this publication may be placed with the Zoological Society of London and the bill can be paid by foreign postal money order. The list price, seven shillings and sixpence, is equivalent to $1.00.

THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been received recently. From:

P. H. Baldwin—1 reprint
Ralph Beebe—1 book
A. J. Berger—6 reprints
G. Reeves Butchart—1 book
Powell Cottrille—1 book
William H. Drury, Jr.—1 reprint
Karl W. Haller—12 books
F. Haverschmidt—4 reprints
Philip S. Humphrey—7 reprints
Mrs. Dinah H. Kahn—34 magazines
S. Charles Kendeigh—7 reprints
Amelia R. Laskey—3 reprints
Rosario Mazzeo—1 book
Margaret M. Nice—5 reprints
Fred M. Packard—2 books, 157 reprints, 384 magazines
Williams H. Phelps—4 reprints
William F. Rapp, Jr.—26 reprints
W. E. Scott—15 pamphlets
Arthur E. Staebler—1 pamphlet
Paul A. Stewart—1 reprint
A. W. Stokes—1 reprint
Robert W. Storer—2 reprints
Richard M. Straw—6 reprints
Harrison B. Tordoff—33 reprints
University of Utah—10 reprints
J. Van Tyne—1 book
Mr. and Mrs. C. R. Wagner—4 magazines
Harriet B. Woolfenden—2 books

THE MEMBERSHIP COMMITTEE

The Membership Committee listed below consists largely of members from the general region of the annual meeting. Your chairman has found it profitable to emphasize the recruiting of new members each year in a different area, that of the annual meeting. We still expect each member to be alert in helping to build our membership. As a means of bolstering individual effort, the Treasurer mailed with the dues notices an application form rather than a nomination form. However, any of the members of the committee listed here will be happy to receive nominations.

Ben B. Coffey, Jr.
672 N. Belvedere
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Marshall College
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ORNITHOLOGICAL LITERATURE

A Guide to Bird Finding West of the Mississippi. By Olin Sewall Pettingill, Jr. Oxford University Press, 1953: 4¼ × 7⅜ in., xxiv + 709 pp., 36 pen-and-ink sketches by George Miksch Sutton. $6.00.

The Pettingill guides to bird finding are earning a place alongside the Peterson guides to identification as indispensable equipment for the field student in the United States. This volume covers the states west of the Mississippi River (including Minnesota and Louisiana), picking up where the Eastern guide, issued in 1951, left off.

It is truly an ornithological geography of the Western states. Although, first of all, it provides a directory of places to see birds in the wild, it provides also much other information of regional interest—about zoos, museums, bird clubs, and available literature.

This guide is intended primarily to help people traveling to an unfamiliar part of the country, but it is much more than a mere directory. All readers will find useful facts in it, particularly in the introductory portion of the chapter on each state, where there is a discussion of the climate, topography, and plants as they affect the bird life of the region. This information about the Western states is not gathered into any other work to my knowledge. For this alone, the guide will earn a place on many library shelves. There are other items of information that could not easily be found elsewhere. Such an item is that about a 20-acre patch of virgin prairie, never plowed or grazed, near Cherokee, Iowa.

In this work there are many evidences of thoughtful consideration for the problems of the traveler. Localities are discussed under the name of the nearest city or village listed in the Rand McNally road map of the state. Highway directions are given in detail, down to the last unmarked lane. Other suggestions cover overnight accommodations, special clothing needed, and tips on the pronunciation of difficult Spanish and Indian names.

This work is a notable achievement of cooperative effort. It could not have been written from the experience nor even from the reading of one man alone. It is a compendium of the knowledge, much of it previously unpublished, of more than 300 cooperators who are intimately acquainted with their own areas.—Harold F. Mayfield.

A Field Guide to the Birds of Britain and Europe. By Roger Tory Peterson, Guy Mountfort and P. A. D. Hollom. Wm. Collins Sons and Company, London; and Houghton Mifflin Company, Boston, 1954: 4½ × 7¼ in., xxxiv + 318 pp., illustrated by Roger Peterson with 40 color plates, 24 half-tone black-and-white plates, 32 line drawings in the text and 2 end-papers; 368 line distribution maps by P. A. D. Hollom. At time of writing, Swedish, Dutch, German, and Swiss (in French) editions also available. Price of U.S. edition, $5.00.

This new book confines within the tiny space of some 26 cubic inches the most important published contribution to the advance of European field ornithology since field ornithology assumed its position as a science (and art) in its own right. Mountfort (Secretary of the British Ornithologists' Union) has contributed the main part of the text, Hollom (an editor of *British Birds* and editor of Witherby's *Popular Handbook of British Birds*) the material on geographical distribution and maps, and Peterson the plates and planning, as well as an important part of the text. All three authors have, as this reviewer has witnessed, worked together in a tight collaboration involving ruthless cross-criticism; and the result is nearly perfect.

As the author of a series of field-recognition books the reviewer is well aware how eagerly some critics can hurl themselves upon the details of text and illustrations and make a great show of correcting the proofs at the expense of an appreciation of the book as a whole. In the case of *A Field Guide to the Birds of Britain and Europe* such pedants can make (and have made) a poor showing, pushing Hollom's map-areas a few miles here or there, infrequently modifying Mountfort's choice of field-marks or voice-transliterations, occasionally trying to catch the great Peterson in some slight error or exaggeration in depiction. The bag of such fair game has been incredibly low; for the book is a triumph of accuracy. But, beyond this, it is a triumph of presentation and planning, and performs the service for which it was designed better than the most particular and demanding customer could ever have expected.

The area covered by this book is all Europe west of Long. 30° E. Within this area are found 452 'basic' species, and a little over 100 others that are now extinct or have occurred less than 20 times. This compares interestingly with the 440 species and 74 accidentals in Peterson's Eastern (U.S.) Field Guide; the small extra number of European species are carried by four more color plates. None of the accidentals in the European Field Guide is figured, but no less than 1172 individuals or details of the 452 others are drawn or painted. Peterson has never done his unique type of recognition portraits more beautifully or lucidly; clearly he has learned the European birds so quickly and accurately (in several long seasons in the field) that he has been able to improve, difficult as this may seem, even on the quality of the revised edition of his *A Field Guide to the Birds* (1947).

In general treatment the book follows the plan of the Eastern Field Guide, save that under each species a section on *Habitat* replaces the section on *Range* which is nearly always covered by a map. Dutch, German, Swedish, French and American vernacular names are given. There is a very helpful introductory chapter on 'How to Identify Birds', another on 'The Problem of Subspecies', a personal check-list, a good description of the accidentals, and a well-arranged index. Praise is due Messrs. Collins, at whose Glasgow press the book was printed, and to Messrs. Gilchrist of Leeds, England, who made the color and half-tone blocks, which are specially good; it is no fault of theirs that in a few copies one or two plates may be found to be printed off-register.

It is not often that a bird book can be recommended as a universal 'must'—but such is *A Field Guide to the Birds of Britain and Europe*. The visitor to Europe will be only half a bird-watcher without it. We in Britain know few stay-at-home North Americans, but if there are such persons they can scarcely be wise to overlook a new Peterson Field Guide; and this one covers very many species on the A. O. U. Check-List.

Many must note with wry sympathy the dedication—"to our long-suffering wives." JAMES FISHER.

LIFE HISTORIES OF NORTH AMERICAN WOOD WARBLERS. By Arthur Cleveland Bent. U.S. National Museum. Bull. 203. Washington, D.C., 1953: xi + 734 pp., 83 halftone plates. $4.50

This is the nineteenth in Mr. Bent's series of bulletins dealing with the life histories of North American birds. Since the previous eighteen have been reviewed in ornithological journals throughout the world, a reviewer of the present volume may well wonder what remains to be said.

The wood warblers constitute an exclusively New World family, of exceptional interest to students of evolution and speciation. Almost every habitat, from rain forest to desert,

has its peculiarly-adapted warbler species. Wood warblers breed from the tropics to the arctic. Many a student traces his awakening interest in birds to his first good view of the flashing colors of a warbler.

Like other volumes in the series, this one aims to be complete insofar as our present knowledge allows. Mr. Bent concludes his introduction with this sentence, "If the reader fails to find in these pages anything that he knows about the birds, he can only blame himself for failing to send the information to—*The Author*." Subject to fairly long delays in printing after the manuscript was finished, this perfectionist aim is rather well met. The student who does know facts about wood warblers which do not appear in the present pages is quite likely to find that these things have been learned (or published) since 1945, when Mr. Bent's manuscript was completed.

Since "monumental" has seemed to so many other reviewers the apt adjective for Mr. Bent's work, it should perhaps be repeated in describing this volume. To a bird student who dwells outside New England, however, certain questions are likely to occur, and certain disagreements appear. Although Mr. Bent has utilized the special knowledge of some bird students outside the Northeast, would it not have been better to have assigned to western ornithologists the preparation of appropriate life histories? As in past volumes, the late Dr. Winsor M. Tyler and Dr. A. O. Gross have contributed complete life histories. Edward von S. Dingle, Alexander Sprunt, Jr., and Josselyn Van Tyne, all non-New England bird students, have each contributed two life histories of species concerning which they have special knowledge. Might not the volume have benefited from a wider use of such authors?

It is everlastingly to the credit of New England bird students that they were pioneers in ornithological exploration. Their voluminous, and often charming, writings reduced certain other sections of the country to a state of "ornithological illiteracy." In short, they were too good and too thorough for many of the rest of us. The inevitable result of this, however, is that certain life histories have, for outside readers at least, a kind of New England parochialism. Many warbler species migrate through, and breed in, vast areas outside the Northeast, and it is certainly true that they do not always behave in other areas as they do in New England.

A good number of species, both of northern and southern associations, are peripheral in New England, and thus are likely to exhibit those aberrations of behavior which are common to animals (and plants) in zones of ecological tension. Students familiar with species near the centers of their abundance will often fail to recognize the limitations of behavior which older New England authors place upon them.

There is a very human tendency to place undue emphasis upon the *first* good ornithological writing dealing with any area or any species. Thus, in years gone by when Eastern college students spent summer vacations in the South, they often returned with ornithological information which was entirely new and highly valuable. Now it is quite obvious that a few weeks' residence in an unexplored area did not make these observers "experts" on local bird life, but we have gone on quoting them at great length just as though they were. This is manifestly unfair to resident students who have to their credit many years of observation in a particular area. The explorers continue to be quoted, simply because they were first, while the real local authority is overlooked because he came on the scene later. As history this is good, but it tends to distort the picture of our knowledge of a bird. In many cases we have learned new things; in others the birds themselves have adjusted to new environments.

By this time a good many readers may be ready to dismiss this as the captious comment of a reviewer who must say something after all the complimentary things have been

said. It is not so meant. Our wood warblers are not regional, not national, but international. If New Englanders have done the best writing about them, other sections may only hope that they will in time catch up.—MAURICE BROOKS.

SHEARWATERS. By R. M. Lockley. Devin-Adair Company, New York, 1954:238 pages, 20 pages of illustrations. $4.00.

This is not a new book, but the American edition seems to have appeared more than a decade after its publication in England.

In 1929, when the author and his wife established a residence on the lonely Welsh island of Skokholm, little was known about the life history of the Manx shearwater (*Puffinus puffinus*), of which some ten thousand nested on the island's 242 acres. At that date even the incubation period of the species was grossly underestimated in the literature.

The Lockleys settled in the island's ancient farmhouse, ran sheep as a livelihood, and tirelessly studied the shearwaters for twelve years before this book was first issued. They began with simple observations statistically recorded throughout the seasons, next carried out extensive ringing or banding, later conducted homing experiments that have become famous, and, finally, made voyages to the northernmost and southernmost breeding stations of the Manx shearwater. Throughout the work they welcomed and sought collaboration from anyone capable of aiding them. Skokholm even became a memorable port-of-call, in 1934, for participants in the Eighth International Ornithological Congress.

The results of Lockley's work are already familiar to students of oceanic birds from successive reports that he has published in scientific journals. This book is a faithful summary of the findings up to 1942 (the research has continued since), as well as a colorful and charming account of island life and its pageant of weather, vegetation, and a multiplicity of birds and other creatures.

For ornithological field work it would be hard to find a better model of sound methodology than "Shearwaters." Step by step the author describes his procedure and draws inescapable conclusions. There is a minimum of speculation, and Lockley is as scrupulous as Darwin in weighing every alternative hypothesis that might stem from the same evidence. The book establishes the essential pattern of life history not only of its subject species but also of all other Procellariiformes, from storm petrels to albatrosses. Their prolonged breeding seasons, stylized emotional behavior, equal share of labor by the two parents, means of family recognition, lengthy period of growth (125 days from egg to fledgling in the Manx shearwater), the abandonment and subsequent nocturnal flight of the young, the extraordinary extent of the feeding flights, the length of life, and the amazing and still not fully explained homing feats from distant localities, totally unknown to the birds, are set forth here in classic fashion.—ROBERT CUSHMAN MURPHY.

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SUGGESTIONS TO AUTHORS

Manuscripts intended for publication in *The Wilson Bulletin* should be neatly typewritten, double-spaced, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, carefully consider whether the material is best presented in tabular form. Where the value of quantitative data can be enhanced by use of appropriate statistical methods, these should be used. Follow the A. O. U. Check-List (fourth edition) and supplements thereto insofar as scientific names of United States and Canadian birds are concerned unless a satisfactory explanation is offered for doing otherwise. Use species names (binomials) unless specimens have actually been handled and subspecifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are cited, the citations may be included in the text. All citations in "General Notes" should be included in the text. Follow carefully the style used in this issue in listing the literature cited. Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attach to each a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in black ink and their lettering large enough to permit reduction. The Illustrations Committee will prepare drawings, following authors' directions, at a charge of $1 an hour, the money to go into the color-plate fund. Authors are requested to return proof promptly. Extensive alterations in copy after the type has been set must be charged to the author.

A WORD TO MEMBERS

The Wilson Bulletin is not as large as we want it to be. It will become larger as funds for publication increase. The Club loses money, and the size of the *Bulletin* is cut down accordingly, each time a member fails to pay dues and is put on the 'suspended list.' Postage is used in notifying the publisher of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated on the mailing list and there is a publisher's charge for this service. The *Bulletin* will become larger if members will make a point of paying their dues promptly.

NOTICE OF CHANGE OF ADDRESS

If your address changes, notify the Club immediately. Send your complete new address to the Treasurer, Leonard C. Brecher, 1900 Spring Drive, Louisville 5, Kentucky. He in turn will notify the publisher and editor.

THIRTY-SIXTH ANNUAL MEETING
OF THE
WILSON ORNITHOLOGICAL CLUB

STILLWATER, OKLAHOMA
FRIDAY, APRIL 8, TO SUNDAY, APRIL 10, 1955

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